United States
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**Soil
Conservation
Service**

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Technical
Release 72

User's Guide for the CREAMS Computer Model

Washington Computer Center Version

PREFACE

This technical release explains how to operate the CREAMS computer model. (CREAMS stands for chemicals, runoff, and erosion from agricultural management systems.) The model estimates the effects of these three factors on nonpoint source water pollution. The estimates provide a means of ranking different management systems to indicate their effects on pollution potential.

The CREAMS model originally was developed by scientists of the Agricultural Research Service. Many people contributed to its development and testing. CREAMS has many potential applications in SCS for conservation planning, but use of the model has been limited because computer access was not available in many areas, few SCS personnel knew how to operate the model, and SCS needed a model that could be run with an irrigation option.

SCS and ARS personnel prepared the version of CREAMS that this technical release describes. Special thanks are due ARS scientists W. G. Knisel, A. D. Nicks, G. R. Foster, and G. A. Gander for their assistance.

This version of CREAMS is stored in a computer in the Washington, D.C., USDA Computer Center (WCC). The WCC version of the model can be accessed from any remote Harris terminal or compatible microcomputer with modem. Each SCS state office and national technical center has Harris equipment.

Since 1981 SCS has held training courses for SCS state-office staff in use of the model. Earlier drafts of this guide were prepared for those courses and for subsequent applications of the model in planning. The WCC version of the model and this guide are based on the experience and suggestions of many users.

Note on Pesticides

This guide contains data on pesticides for use in the CREAMS model. All uses of pesticides must be registered by appropriate State or Federal agencies before they can be recommended. In some instances, the guide uses trade names to provide specific information. Mention of a trade name, however, does not constitute a recommendation for use, a guarantee, or an endorsement by the United States Department of Agriculture.

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CHAPTER 1

INTRODUCTION

This guide explains how to run the Washington Computer Center (WCC) version of the field-scale computer model CREAMS (chemicals, runoff, and erosion from agricultural management systems). The guide was written for SCS users of CREAMS who have access to Harris terminals in state offices or to microcomputers with modems. The guide describes the required parameters and their formats and provides instructions for loading the model.

1.1 Purpose of the CREAMS Model

The CREAMS model was developed by a task force formed by the Agricultural Research Service (ARS). Its purpose is to simulate the effects of management systems on nonpoint source water pollution. USDA Conservation Research Report (CRR) 26 describes and documents the model and includes a user's manual. 1/ On the basis of SCS experience with the model, some revisions in its input and output have been made. This guide describes the revisions.

The original version of CREAMS (version 1.7), however, on which many SCS personnel have received training, is still operational. Therefore, for a detailed description of how the model functions, CRR 26 is still applicable. The only differences between version 1.7 and the WCC version are the formats of input and output and the addition of irrigation.

1.2 How This Guide is Organized

Chapter 2 describes the operation of the CREAMS model from remote Harris terminals. It presents the basic formats for coding and entering data. It also provides the job control language (JCL) needed to run the model.

Chapters 3, 4, and 5 discuss the three components of the model--hydrology, erosion/sediment yield, and chemicals (nutrients and pesticides). These chapters describe the required input parameters and their formats and provide instructions for loading the input. Many of the parameter descriptions include references to specific pages in CRR 26, where you can find more information about a parameter. The descriptions also include references to tables and figures in appendices A to D. You can use these tables and figures in selecting values for the parameters.

Chapter 6 presents an example application of the model for a base system of cropland management and for two alternative

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1/ Knisel, W. G. (ed.), CREAMS: A Field Scale Model for Chemicals, Runoff, and Erosion from Agricultural Management Systems, U.S. Department of Agriculture, Science and Education Administration, Conservation Research Report 26, 1980, 643 pages.

systems. The example describes some of the comparisons between systems that CREAMS was designed to make possible.

1.3 Capabilities of the CREAMS Model

The CREAMS model predicts the delivery of runoff, sediment, pesticides, and nutrients from a drainage area within a field. A field is a management unit having (1) a single land use, (2) relatively homogeneous soils, (3) spatially uniform rainfall, and (4) a single management system, such as terraces. Normally, a field is less than 100 acres.

The model functions on a watershed basis within a field. A landformed field may constitute the entire watershed, or a field may comprise several watersheds. The user must select a representative watershed to use within the field. All the model components operate on the same watershed.

The model is divided into three components--hydrology, erosion, and chemicals. Each component operates independently. Figure 1-1 shows how the model operates from a Harris terminal to WCC and return. It also shows the relationships of input parameter files and computer-generated pass files and the form of output from program runs.

1.4 General Approach for Using CREAMS

This section describes a general approach for using CREAMS to evaluate the effects of agricultural management systems on nonpoint source pollution. See chapter 6 for an example application of the model.

1. Choose a field or fields that represent the area suspected of causing an <u>identified</u> problem of nonpoint source water pollution.

2. Gather field information needed to operate the model. This information includes precipitation data, topographic map, and other data for the input parameter files. You can design a worksheet such as that shown in chapter 6 (figure 6-2) to help in recording field data.

3. Organize data on field operations chronologically for a base or existing management system, so that you know everything that happens in the field to affect parameter values. These operations include all tillage, chemical applications, planting and harvesting, and mowing or grazing.

4. Develop the necessary parameter files at the Harris terminal for the selected cropland field(s). Use this guide in developing parameter values. Check with your Harris system operator to determine the file-naming convention used at your location, and develop a file-naming scheme for your CREAMS parameter and pass files. An example is shown in chapter 6.

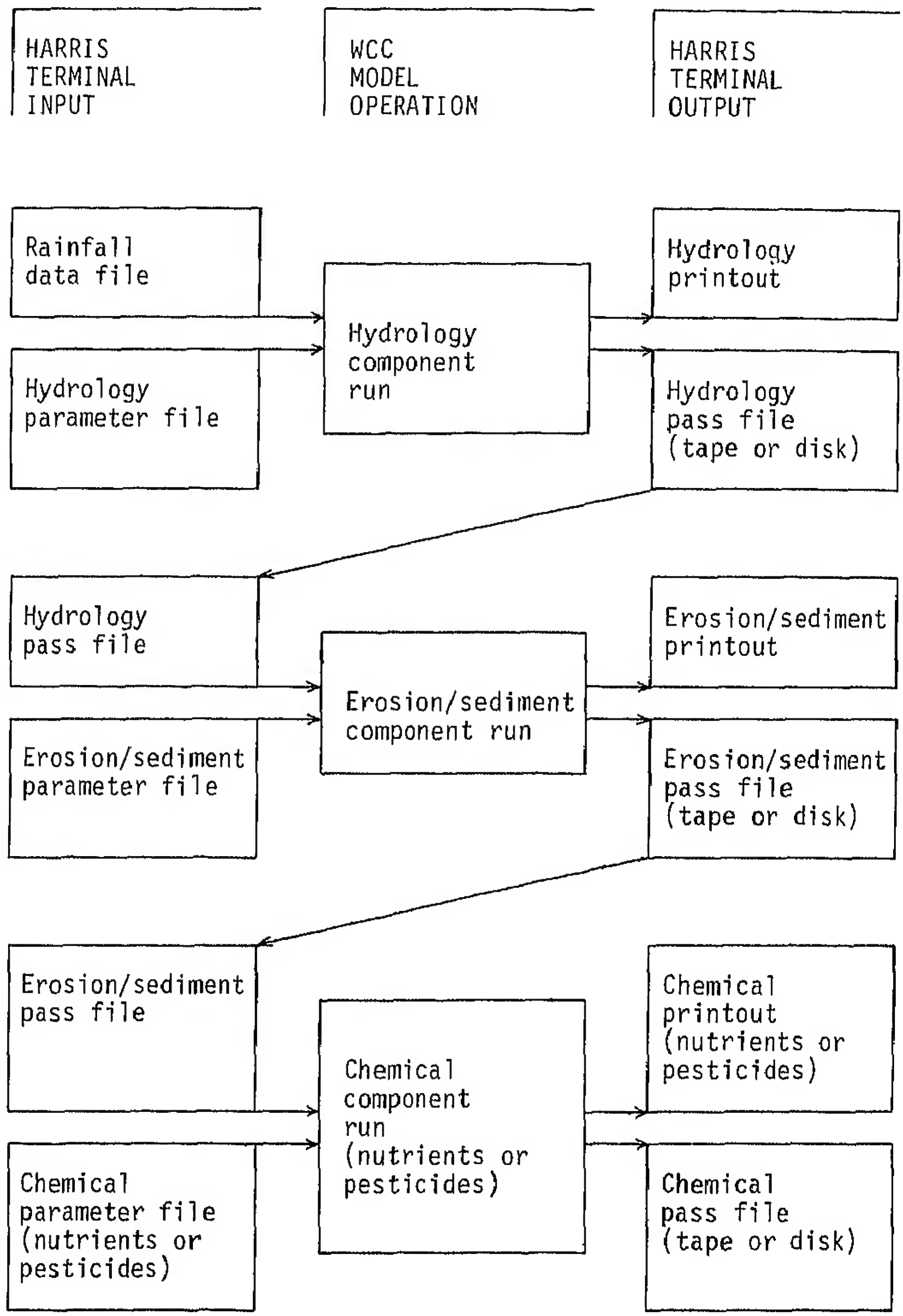

Figure 1-1.--Flow chart of CREAMS model operation (WCC version).

5. Run the model for the base or existing management system described in step 3. Ask your terminal operator to send your job to WCC using the appropriate JCL's in chapter 2. When you obtain the results, look them over carefully to see if they seem reasonable.

6. Select an alternative agricultural system (using different structural, management, or vegetative measures) for simulation and organize the data for the alternatives (repeat step 3).

7. Develop new or modified computer files to reflect the new parameters (step 4). In many applications, the file developed in step 4 can be duplicated and a few changes made in the parameters to reflect the alternative system.

8. Order the appropriate computer runs at WCC and review your results for reasonableness.

9. Compare the results from the alternative and base systems, and determine how the alternative affects loading of nonpoint source pollutants. Alternative systems have different effects on different pollutants. Therefore, you may want to devise a means of ranking the systems by effect on specific pollutants.

The output values from the simulations are as accurate as possible, considering the accuracy of the input and the state-of-the-art modeling technology in CREAMS. Remember, however, that the original purpose and the main usefulness of CREAMS is to compare systems for relative differences so that land users and SCS planners can make better decisions.

CHAPTER 2

COMPUTER TERMINOLOGY AND OPERATIONS

This chapter provides the computer terminology, Harris terminal procedure, and job control language needed to operate the model on Washington Computer Center equipment.

2.1 Input Files

Two types of input files--data files and parameter files--are required to run each component of CREAMS. Figure 1-1 (page 1-3) illustrates the relationships of these files and the model components.

The hydrology component's data file consists of either daily (option 1) or breakpoint or hourly (option 2) precipitation data. Its parameter file describes the field's hydrologic conditions. When these two files are used as input for the hydrology component, the results of the simulation are a printed output file and a pass file.

The hydrology pass file is the data file for the erosion/sediment component. The parameter file for this component describes the field erosion and sediment transport conditions during the simulation period. The erosion/sediment component also has two outputs--a printed file and a pass file.

Similarly, the chemical component uses the erosion/sediment pass file and a parameter file to describe chemical applications and reactions within the field. The chemical component's outputs are a printed file of the simulated results and an optional pass file of storm-by-storm results. Some users have applied statistical analysis software to the pass file for a more indepth analysis than that provided by routine CREAMS output.

All the pass files are stored at the originating terminal and require some user action. First, identify each pass file with a file name when it is received by the Harris terminal. Second, edit the pass file by deleting the first two lines of data generated by WCC: a line of lowercase letters and a blank line. The first valid line of an edited pass file begins with a Julian date.

Julian date is a five-digit code for year and day; for example, 74001 is the Julian date January 1, 1974. Use appendix table A-1 to convert calendar date to Julian date. Some parameters in the model use a three-digit code when only the day, not the year, is required.

2.2 Operation and File Management

The operation of the CREAMS model is patterned as closely as possible on automated data processing (ADP) procedures and equipment used by SCS personnel. The model is accessible from any SCS location with a remote job entry (RJE) terminal. Program control or job control language (JCL) statements, data

files, and parameter files are transmitted from the Harris terminal to the WCC.

Output files are normally received at the originating terminal as printed summaries and punched pass files. Output from WCC can also be routed to other terminals. The punched pass file is input for the next model component and normally is stored on disk or magnetic tape at the terminal site.

2.3 Data and Parameter Formats

With a few exceptions, the model uses four standard formats for coding and entering files. These four formats have been made as uniform as possible. Each format contains 80 columns or characters per line. Figures 2-1 through 2-4 give information needed by Harris terminal operators to set up the formats. Figure 2-5 defines the operating codes.

<u>Format 1</u>

10X,10F5.2,20X

This format is used only for entering daily rainfall files. 10X represents a field of 10 columns of characters. This field is not read by the computer; it identifies the line of data for reference by the user, by giving information such as raingage number and year. 10F5.2 represents 10 data fields, for example, amounts of daily rainfall for 10 days. Each field contains five characters; at least one but no more than two characters are decimal values. 20X represents 20 columns that further identify the data line, for example, a card number. To set up this format, refer the Harris operator to figure 2-1.

<u>Format 2</u>

20A4

20A4 represents 20 fields of 4 characters each. These data are alphanumeric (letters or numbers). This format is used to enter Title card information. See figure 2-2.

<u>Format 3</u>

10I8 or 10F8.0

10I8 represents 10 fields--8 columns each--of integer data, such as control flags used for program execution controls. The 10F8.0 format is the same, except the data in the eight-column fields are real numbers, which require a decimal point. Card 4 in all model components uses the 10I8 format; nearly all other parameter cards use the 10F8.0 format. See figure 2-3.

<u>Format 4</u>

4A4

4A4 represents alphanumeric information. This format is used to enter pesticide names in the pesticide component of the chemical model. See figure 2-4.

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FORMAT/41 CONTROL RECORD DEFINITION FORM

CONTROL RECORD FILE NAME

( )

JOB NAME CREAMS

Control Record # 425

Format Purpose RAINFALL FILE

FIELD NAME	F#	OPC	ATTR	MOD	BEG	END	COMMENTS
	01	AF		10			
	02	AF	R	5			
	03	AF	R	5			
	04	AF	R	5			
	05	AF	R	5			
	06	AF	R	5			
	07	AF	R	5			
	08	AF	R	5			
	09	AF	R	5			
	10	AF	R	5			
	11	AF	R	5			
	12	BF		18			
	13	NF	ZE	2			
	14	EN		425			
	15						
	16						
	17						
	18						
	19						
	20						
	21						
Reverse Pointer	22	REV					
Next Form	23	NXT		425			
Screen Prompts	24						

C R E A M S - - R A I N F A L L

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Figure 2-1.--Control record information, format 1 (10X, 10F5.2, 20X).

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FORMAT/41 CONTROL RECORD DEFINITION FORM

CONTROL RECORD FILE NAME

( )

JOB NAME CREAMS

Control Record # 426

Format Purpose TITLE

FIELD NAME	F#	OPC	ATTR	MOD	BEG	END	COMMENTS
	01	AF		80			
	02	EN		426			
	03						
	04						
	05						
	06						
	07						
	08						
	09						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
Reverse Pointer	22	REV					
Next Form	23	NXT		427			
Screen Prompts	24						

C	R	E	A	M	S	-	-	T	I	T	L	E

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Figure 2-2.--Control record information, format 2 (20A4).

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FORMAT/41 CONTROL RECO
DEFINITION FORM

CONTROL RECORD FILE NAM

(____________

JOB NAME CREAMS

Control Record # 427

Format Purpose 8-COL DATA

FIELD NAME	F#	OPC	ATTR	MOD	BEG	END	COMMENTS
	01	AF	R	8			
	02	AF	R	8			
	03	AF	R	8			
	04	AF	R	8			
	05	AF	R	8			
	06	AF	R	8			
	07	AF	R	8			
	08	AF	R	8			
	09	AF	R	8			
	10	AF	R	8			
	11	EN		427			
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
Reverse Pointer	22	REV					
Next Form	23	NXT		427			
Screen Prompts	24						

C R E A M S - I N P U T P A R A M E T E R S

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F157

Figure 2-3.--Control record information, format 3 (10I8 or 10F8.0).

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COMMUNICATION AND INFORMATION PROCESSING

FORMAT/41 CONTROL RECORD DEFINITION FORM

CONTROL RECORD FILE NAME

(________________)

JOB NAME CREAMS

Control Record # 428

Format Purpose PESTICIDE NAME

FIELD NAME	F#	OPC	ATTR	MOD	BEG	END	COMMENTS
	01	AF		8			
	02	BF		16			
	03	EN		427			
	04						
	05						
	06						
	07						
	08						
	09						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
Reverse Pointer	22	REV					
Next Form	23	NXT		428			
Screen Prompts	24						

CREAMS--PESTICIDE NAME

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Figure 2-4.--Control record information, format 4 (4A4).

FORMAT 41 OPCODE/MODIFIER DESCRIPTIONS

OPCODE	FUNCTION	ATTRIBUTES	MODIFIER	MODIFIER RANGE
Alpha/Numeric				
AF	Alpha Shift	C,R,E,I,F,L,O	Field Length	1-99
AS	Auto Skip	C R,E I,F,L,O	Field Length	1-99
AD	Auto Dup	C,R E I,F,L,O	Field Length	1-99
AV	Verify Bypass	C R E,I F,L,O	Field Length	1-99
NF	Numeric Shift	C S R Z E I F,L B	Field Length	1-99
NS	Auto Skip	C,S R,Z E I F,L B	Field Length	1-99
ND	Auto Dup	C S,R Z E,I F L B	Field Length	1-99
NV	Verify Bypass	C S R Z E I F,L B	Field Length	1-99
BF	Verify/Entry Bypass	None	Field Length	1-99
Check Digit				
TF	Mod 10	C,E I	Field Length	1-99
TS	Auto Skip	C,E I	Field Length	1-99
TD	Auto Dup	C,E,I	Field Length	1-99
TV	Verify Bypass	C,E I	Field Length	1-99
EF	Mod 11	C,E I	Field Length	1-99
ES	Auto Skip	C,E,I	Field Length	1-99
ED	Auto Dup	C E,I	Field Length	1-99
EV	Verify Bypass	C,E I	Field Length	1-99
Accumulator				
XC	Clear	None	n Accumulator	0-3 12, 13, 23
XD	Display	None	n Accumulator	0-3, 12 13, 23
XA	Add	None	n Accumulator	0-3, 12, 13, 23
Insertion				
I1	Value of Accumulator #1 To Field	S,R,Z,L B	Field Length	1-99
I2	Value of Accumulator #2 To Field	S,R Z,L,B	Field Length	1-99
I3	Value of Accumulator #3 To Field	S,R,Z,L,B	Field Length	1-99
D1	Insert 1 Character	None	1 Character	Any Value
D2	Insert 2 Characters	None	2 Characters	Any Value
D3	Insert 3 Characters	None	3 Characters	Any Value
Table				
TI	Table Value Search	None	Table Number	1-255
TO	Non Table Value Search	None	Table Number	1-255
TX	Numeric Index	None	Table Number	1-255
TL	Opcode Index	None	Table Number	1-255
TA	Alpha Table Insert	C,R,E,I,F,L,O	Field Length	1-99
TN	Numeric Table Insert	C,S,R,Z,E,I,F,L,B	Field Length	1-99
Format Control				
EN	End	None	Control Record #0-999	
CO	Continue	None	Control Record #0-999	
CA	Call	None	Control Record #0-99	

* Attribute Selection

During control record creation and maintenance, certain field types can have associated with them one or more valid attributes which may be selected for the various opcodes The attribute letters have the following meaning

E	Must Enter Field	O	Alpha and Blank Only
C	Must Complete Field	F	Right Boundary Release
I	Inhibit Data Display	S	Right Justify Oversign
L	Left Justify Data	R	Right Justify
Z	Zero Fill Numeric	B	Blank Fill

Prompts

Prompts are entered in the same order as the fields described Use an asterisk to separate prompts and mark the position of a field which does not receive prompt

Figure 2-5.--Definitions of operating codes.

2.4 Job Control Language (JCL) Examples

This section provides the JCL for operating the WCC version of CREAMS from remote Harris terminals. A different set of JCL is used to run each model component.

Explanations of certain JCL codes and variables are as follows:

cc = User identification number.
mmm = Optional identifier for uniqueness.
accountinfo = Account number.
rrr = Remote terminal identification number.
st-name = User identifying information.
aaaa = Security information.
Ø = Zero.
COPIES = Number of copies of output desired on the Harris RJE terminal. The internal default is 1; if more copies are desired, change the number to 2, 3, 4, or 5.
The codes for TIME, CLASS, and PRTY can change.

JCL for Hydrology Component

```
//SCSccmmm JOB (accountinfo,RJrrr),'st-name',TIME=(Ø,2Ø),CLASS=C,
// PRTY=Ø3,MSGLEVEL=(1,1)
//*LOGONID aaaa
//*PASSWORD aaaa
/*ROUTE  PRINT RMTrrr
/*ROUTE  PUNCH RMTrrr
//JOBLIB DD UNIT=SYSDA,DSN=SCS157.CRHY3LIB,DISP=SHR
// EXEC PGM=CREMH,REGION=3ØØK
//FTØ6FØØ1 DD DUMMY
//FTØ5FØØ1 DD DUMMY
//FTØ4FØØ1 DD SYSOUT=B
//FTØ3FØØ1 DD SYSOUT=A,COPIES=1
//FTØ1FØØ1 DD *

     ******************
     *  RAINFALL DATA  *
     ******************

/*
//FTØ2FØØ1 DD *


     *************************
     *  HYDROLOGY PARAMETERS  *
     *************************

/*
//
```

JCL for Erosion/Sediment Component

```
//SCSccmmm JOB (accountinfo,RJrrr),'st-name',TIME=(Ø,2Ø),CL
// PRTY=Ø3,MSGLEVEL=(1,1)
//*LOGONID aaaa
//*PASSWORD aaaa
/*ROUTE  PRINT RMTrrr
/*ROUTE  PUNCH RMTrrr
//JOBLIB DD UNIT=SYSDA,DSN=SCS157.CRER3LIB,DISP=SHR
// EXEC PGM=CREME,REGION=3ØØK
//FTØ6FØØ1 DD DUMMY
//FTØ5FØØ1 DD DUMMY
//FTØ3FØØ1 DD SYSOUT=A,COPIES=1
//FTØ4FØØ1 DD SYSOUT=B
//FTØ1FØØ1 DD *

     *************************
     *  HYDROLOGY PASS FILE  *
     *************************

/*
//FTØ2FØØ1 DD *

     **********************************
     *  EROSION/SEDIMENT PARAMETERS   *
     **********************************

/*
//
```

JCL for Nutrient Component

```
//SCSccmmm JOB (accountinfo,RJrrr),'st-name',TIME=(Ø,2Ø),CLASS=C,
// PRTY=Ø3,MSGLEVEL=(1,1)
//*LOGONID aaaa
//*PASSWORD aaaa
/*ROUTE  PRINT RMTrrr
/*ROUTE  PUNCH RMTrrr
//JOBLIB DD UNIT=SYSDA,DSN=SCS157.CRCH2LIB,DISP=SHR
// EXEC PGM=CREMC,REGION=3ØØK
//FTØ6FØØ1 DD DUMMY
//FTØ5FØØ1 DD DUMMY
//FTØ3FØØ1 DD SYSOUT=A,COPIES=1
//FTØ4FØØ1 DD SYSOUT=(B,,NUT1)
//FTØ7FØØ1 DD SYSOUT=(B,,NUT2)
//FTØ1FØØ1 DD *


     *******************************
     *  EROSION/SEDIMENT PASS FILE *
     *******************************

/*
//FTØ2FØØ1 DD *

     *************************
     *  NUTRIENT PARAMETERS  *
     *************************

/*
//
```

JCL for Pesticide Component

```
//SCSccmmm JOB (accountinfo,RJrrr),'st-name',TIME=(Ø,2Ø),CLASS=C,
// PRTY=Ø3,MSGLEVEL=(1,1)
//*LOGONID aaaa
//*PASSWORD aaaa
/*ROUTE  PRINT RMTrrr
/*ROUTE  PUNCH RMTrrr
//STEP1 EXEC PGM=IEBGENER,REGION=5ØK
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD UNIT=SYSDA,DSN=&&PAR,DISP=(NEW,PASS),
//  SPACE=(TRK,(2,1)),DCB=(RECFM=FBA,LRECL=8Ø,BLKSIZE=168Ø)
//SYSUT1 DD *


     **************************
     *  PESTICIDE PARAMETERS  *
     **************************


/*
//STEP2 EXEC PGM=CREMC,REGION=3ØØK
//STEPLIB DD UNIT=SYSDA,DSN=SCS157.CRCH2LIB,DISP=SHR
//FTØ6FØØ1 DD DUMMY
//FTØ7FØØ1 DD SYSOUT=B
//FTØ3FØØ1 DD SYSOUT=A,COPIES=1
//FTØ4FØØ1 DD SYSOUT=B
//FTØ5FØØ1 DD UNIT=SYSDA,DSN=&&CRETEM,DISP=(NEW,PASS),
//    SPACE=(TRK,(2,1)),DCB=(RECFM=FBA,LRECL=8Ø,BLKSIZE=168Ø)
//FTØ2FØØ1 DD UNIT=SYSDA,DSN=&&PAR,DISP=(OLD,PASS),
//  DCB=(RECFM=FBA,LRECL=8Ø,BLKSIZE=168Ø)
//FTØ1FØØ1 DD *


     *******************************
     *  EROSION/SEDIMENT PASS FILE *
     *******************************


/*
//
```

CHAPTER 3

HYDROLOGY COMPONENT

The hydrology component contains models for computing runoff, soil moisture, percolation through the root zone, and evapotranspiration within the selected watershed. The component requires a precipitation data file for the period of simulation and a hydrology parameter file.

3.1 Precipitation Data File

There are two modeling options for the precipitation file in the hydrology component. Option 1, the daily rainfall model, uses the SCS curve number procedure (see section 3.2). Option 2, the hourly or breakpoint rainfall model, uses an infiltration procedure (see section 3.3).

Irrigation can be simulated in two ways:

1. Under option 1 or 2, the rainfall file can be modified to show the quantity of water applied on particular days.

2. Under option 1 only, available soil moisture can be tracked. When it drops below a user-defined minimum, the model simulates the addition of enough water to raise the available soil moisture to a higher, also user-defined, amount (that is, to some fraction of field capacity).

3.2 Option 1: Daily Rainfall Model

Daily rainfall data can be obtained from monthly summaries of the National Weather Service (NWS). Each state office and engineering staff has a set of these summaries.

Cards 1 to 37 — R(1), R(2), R(3), ... R(366)

R(1-366) — Daily rainfall (in), e.g. 2.07

Record daily rainfall data on computer coding forms, using format 1--10X, 10F5.2, 20X (see section 2.3). The model does not read the first 10 spaces (10X) and last 20 spaces (20X). Use the first 10 for the rainfall year; the last 20 are commonly used to enter card numbers. Data in the 10 rainfall data fields (10F5.2) are right justified, and a decimal (maximum of two decimal places) must be entered for all real numbers. However, if no rainfall occurs on a day, enter a zero or leave the space blank (the computer will read a blank as zero).

Figure 3-1 is a sample of data for part of 1 year (January 1 to February 19, 1974). In the sample, the first rainfall entry is for January 1. The model requires an entire year of rainfall data, and data for 10 days can be entered on each card, so 37 cards are necessary for the year. If the user wants to simulate 10 years of rainfall, 370 cards are required.

74	2.07	.16	.37	.17	0	0	.34	0	0	0	1
74	.08	0	0	0	0	0	0	0	0	.87	2
74	0	0	0	.24	0	0	0	.10	.26	0	3
74	0	0	0	0	0	0	1.70	.20	0	0	4
74	0	0	0	0	.65	.90	0	0	0	.16	5

Figure 3-1.--Sample of option 1 (daily rainfall) data.

3.3 Option 2: Hourly or Breakpoint Model

The breakpoint rainfall model (option 2) uses data from hourly or breakpoint precipitation records. The model does not require coding for an entire calendar year. It requires data only for the events you want to evaluate. Hourly rainfall data are available at some National Weather Service stations. Breakpoint precipitation data (time-intensity data) are available at several ARS research watershed locations.

Card 1 — JYR, JDAY, NP, MIDNI, PRE(JDAY)

Format for card 1 is 4I8,F8.0.

JYR — Year of event (last 2 digits), e.g. 74

JDAY — First day (Julian) of event, e.g. 001 (table A-1, page A-2)

NP — Number of breakpoints in the event, e.g. 6; use one card 2 for each breakpoint.

MIDNI —
0 If event takes place during only one day;
1 If event overlaps into the next day.

If the actual rainfall event lasts longer than 2 days, divide it into separate events.

PRE() — Total rainfall (in) for event, e.g. 2.07

Card 2 — BP(1-NP), T(1-NP)

Format for card 2 is 2F8.0.

BP() — Accumulated rainfall (in) at time T(), e.g. 1.96

T() — Time of measurement (minutes after midnight), e.g. 38.0

Note — A card 1 and a series of card 2's are used for each event during the simulation. A card 2 is used for each breakpoint (NP, card 1) during the event.

Example

Figure 3-2 is a sample of breakpoint data for two events on January 1 and 2, 1974. For the first event, precipitation began 1 minute after midnight on January 1. At first, the storm was intense; it produced 1.96 inches of precipitation by 38 minutes after midnight. Intensity then decreased; cumulative precipitation was 2.03 inches at 47 minutes and 2.07 inches at 180 minutes after midnight.

The second event began at 8:13 p.m. (1213 minutes after midnight) on January 2. It produced 0.16 inch of rain and ended at 8:30 p.m.

74	1	6	0	2.0700
0.0	1.0			
1.9600	38.0			
2.0300	47.0			
2.0400	54.0			
2.0500	154.0			
2.0700	180.0			
74	2	5	0	.1600
0.0	1213.0			
.0500	1215.0			
.0800	1217.0			
.0900	1223.0			
.1600	1230.0			

Figure 3-2.--Sample of option 2 (breakpoint rainfall) data.

3.4 Hydrology Parameters

The hydrology parameters are data on watershed characteristics required by the hydrology component.

Figures 3-3 and 3-4 illustrate the arrangement of card decks for options 1 and 2, respectively. Figure 3-5 is a complete parameter set for a 3-year run of the hydrology component using option 1.

Appendices A and B are provided to help the user estimate parameter values; however, use field-measured values if available. For selected hydrology parameters, table 3-1 indicates sources of estimates and quality of estimates.

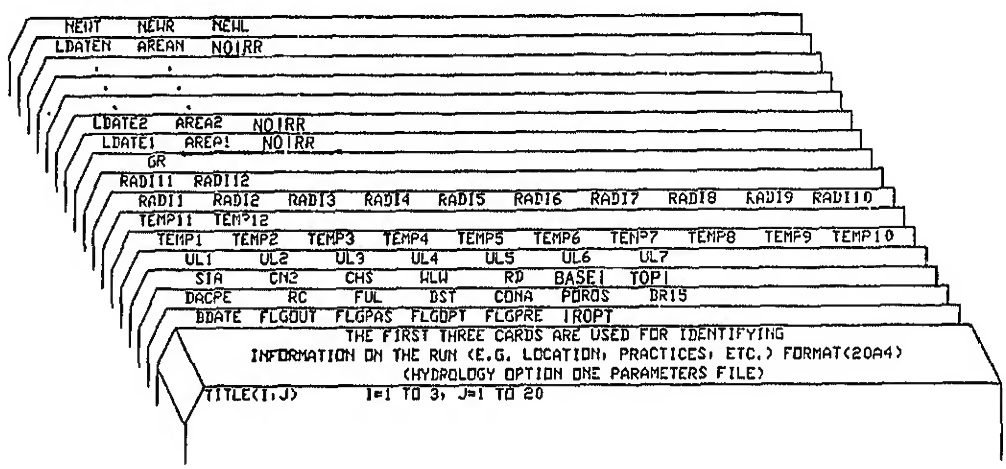


Figure 3-3.--Sample deck arrangement of input parameters for hydrology component, option 1 (daily rainfall).

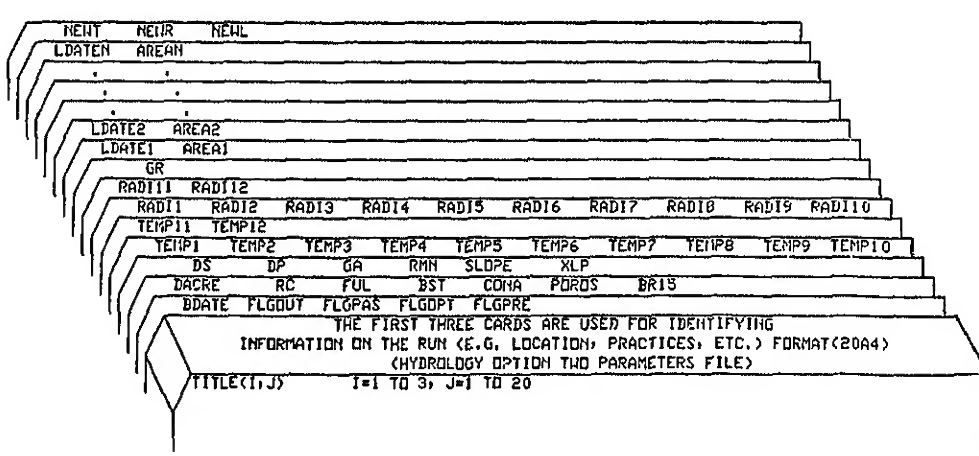


Figure 3-4.--Sample deck arrangement of input parameters for hydrology component, option 2 (breakpoint rainfall).

Card No.										
1	DAILY HYDROLOGY PARAMETERS									
2	CONVENTIONAL MANAGEMENT									
3	CONTINUOUS CORN									
4	73138	0	1	1		0				
5	3.200	0.190	0.750	0.500	3.750	0.410	0.170			
6	0.200	80.000	0.022	2.100	24.000					
7	0.160	0.820	0.720	0.520	0.610	0.700	0.660			
8	45.0	47.0	52.0	61.0	70.0	77.0	79.0	78.0	73.0	63.0
9	51.0	44.0								
10	218.0	290.0	380.0	488.0	533.0	562.0	532.0	508.0	416.0	344.0
11	268.0	211.0								
12	1.000									
13	1	0.000								
13	122	0.000								
13	135	0.09								
13	148	0.19								
13	161	0.23								
13	174	0.49								
13	187	1.16								
13	200	2.97								
13	213	3.00								
13	226	2.72								
13	239	1.83								
13	255	0.00								
13	366	0.00								
14	0	0	0							
14	0	0	0							
14	-1	0	0							

Figure 3-5.--Example of hydrology input parameter file, option 1 (daily rainfall).

Table 3-1.--Hydrology component: Definitions, sources, and quality of estimates for selected parameters

Parameter	Model option	Definition	Source of estimate	Quality
DACRE	Both	Field area in acres	Measurable	Good
RC	Both	Saturated hydraulic conductivity, in/hr	Estimate from SCS soil or measure, infiltrometer; or table A-2	Poor to good, sensitive
FUL	Both	The fraction of storage (plant-available and drainage water) filled at field capacity for the effective root zone	Table A-3	Well defined
BST	Both	Fraction of plant-available water storage filled when simulation begins	Field measure	Not sensitive
CONA	Both	Soil evaporation parameter, α_s	Table A-3	Fair
POROS	Both	Ø, soil porosity	Table A-3	Not sensitive
BR15	Both	Immobile soil water content	Table A-3	Not sensitive
SIA	1	Initial abstraction coefficient, CN method	Use 0.2 in absence of measured value	Fair
CN2	1	SCS curve number for antecedent moisture condition II	Tables A-4, A-5	Fair
CHS	1	Channel slope	Field measurement	Good
WLW	1	Watershed length/width ratio	Watershed map	Good
RD	1	Depth of root zone	Knowledge of soil	Fair
BASEI	1	Fraction of plant available water content to start irrigation	Field estimate	Good

Table 3-1, continued.

Parameter	Model option	Definition	Source of estimate	Quality
TOPI-------1		Fraction of plant available water content after irrigation	Field estimate	Good
UL(1-7)----1		The upper limit of storage of plant-available and drainage water for each layer of the 7 layers in the root zone (inches)	Difference between total soil porosity and 15-bar water content	Fair to good
DS---------2		Depth of surface soil layer	User estimate. Range of 0.2 to 2.0 inches	Varies, subjective
DP---------2		Depth of root zone in soil	Knowledge of soil	Fair
GA---------2		Effective capillary tension	Soil data; infiltrometer tests; table A-6	Fair to good
RMN--------2		Manning roughness for field surface	Table B-2	Good, subjective
SLOPE------2		Average field slope	Maps; field survey	Good
XLP--------2		Length of flow plane	Maps; field survey	Good
TEMP(1-12)-Both		Average monthly temperature (read 12 values), °F	Climatological data	Good, as averages
RADI(1-12)-Both		Average monthly net radiation (read 12 values), langleys/day	Climatological data or table A-7	Good, as averages
GR---------Both		Winter cover factor	Crop information	Rough
AREA-------Both		Leaf area index (must specify day 001 and day 366)	Crop information; table A-8	Good

:ds 1 to 5, :h Options

This section describes parameters for cards 1 to 5 and cites an appendix table or other source where parameter values are listed. In this chapter and chapters 4 and 5, example values (numbers following the "e.g." notation) indicate whether decimals are needed. Default values are labeled.

:ds 1 to 3 — TITLE

TITLE — Three 80-character lines of alphanumeric information that identifies the computer output.

'd 4 — BDATE, FLGOUT, FLGPAS, FLGOPT, FLGPRE, IROPT

BDATE — The beginning date (Julian year and day) for simulation, e.g. 73138

BDATE must be less than the first storm date; for example, if the first rainfall is 74001, you must use 74000 for BDATE.

FLGOUT
- 0 For annual summary output;
- 1 For storm-by-storm and annual summary output.

FLGPAS
- 0 If no hydrology pass file is to be created;
- 1 If the program is to create a hydrology pass file for the erosion/sediment component.

FLGOPT
- 1 For the daily rainfall model (option 1);
- 2 For the breakpoint or hourly rainfall model (option 2).

FLGPRE
- 0 For breakpoint precipitation data;
- 1 For hourly precipitation data.

Enter a FLGPRE value only for hydrology option 2, that is, where FLGOPT = 2.

IROPT
- 0 If irrigation is not to be considered;
- 1 If program is to apply irrigation water on demand.

i 5 — DACRE, RC, FUL, BST, CONA, POROS, BR15

DACRE — Drainage area (acres) within the field, e.g. 3.2

RC — Effective saturated conductivity (in/hr) of the soil, e.g. 0.19; estimate from table A-2, page A-4. (CRR 26, p. 184)

FUL — Fraction of pore space filled at field capacity, e.g. 0.75; estimate from table A-3, page A-4.

BST Fraction of available water content that is filled when simulation begins, e.g. 0.50

Estimate should be made for field moisture conditions at beginning of simulation. (CRR 26, p. 339)

CONA Soil evaporation parameter, e.g. 3.75; estimate from table A-3. (CRR 26, p. 32)

POROS Soil porosity (in/in), e.g. 0.41; estimate from table A-3.

BR15 Wilting point--immobile soil water content (in/in) at 15 bar tension, e.g. 0.17; estimate from table A-3.

Note Figure 3-6 shows the relationship of several parameters relating to soil moisture and pore space. Three of the parameters--FUL, BR15, and POROS--are entered on card 5. RD is on card 6 (option 1), and UL is on card 7 (option 1). AWC is used to estimate BASEI and TOPI (card 6, option 1), and FC is used in FUL computation.

The relationships among these variables are expressed as follows:

$$AWC = FC - BR15,$$

$$UL = (POROS - BR15) \times RD \times (\text{depth of soil layer, inches})$$

and

$$FUL = \frac{(FC - BR15)}{(POROS - BR15)}$$

where

AWC = Available water content for plant uptake,
FC = Field capacity in volumetric water content at 1/3 bar tension,
BR15 = Wilting point at 15 bar (see description, card 5),
UL = Total soil water storage (card 7, option 1),
POROS = Volume of voids (card 5),
RD = Maximum rooting depth (card 6, option 1), and
FUL = Fraction of pore space filled at field capacity (card 5).

3.6 Cards 6 and 7, Option 1

Card 6 SIA, CN2, CHS, WLW, RD, BASEI, TOPI

SIA Initial abstraction coefficient for SCS curve number method; use 0.2 (CRR 26, p. 179)

CN2 Condition II SCS curve number, e.g. 80.0; refer to tables A-4 and A-5.

For detailed discussion of curve numbers, see SCS National Engineering Handbook, Section 4, Hydrology.

CHS Hydrologic slope (ft/ft) for the field, e.g. 0.022 (CRR 26, p. 339)

Use field map and calculate CHS as follows:

$$CHS = \frac{\text{Maximum difference in field elevation, ft}}{\text{Length of longest flow path in field, ft}}$$

WLW Ratio of watershed length to width, e.g. 2.1 (CRR 26, p. 339)

Use field map and compute WLW as follows:

$$WLW = \frac{(\text{Length of longest flow path, ft})^2}{\text{Drainage area, ft}^2}$$

RD Effective rooting depth (in), e.g. 24.0 (CRR 26, p. 504 or 78)

BASEI Fraction of available water content, AWC, in the root zone when the program is to apply irrigation, e.g. 0.25; leave BASEI blank if IROPT = 0.

TOPI Fraction of available water content, AWC, in the root zone after irrigation, e.g. 0.80; leave TOPI blank if IROPT = 0.

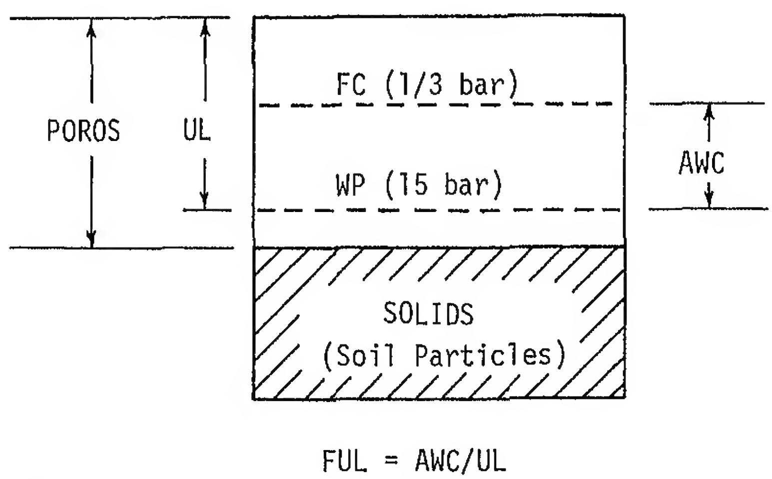


Figure 3-6.--Schematic of soil sample and parameter values relating to water content.

Card 7 UL(1-7)

UL() Total soil water storage (in) for each of seven soil storages, e.g. 0.16 (CRR 26, p. 339)

See figure 3-6 and table A-3. Calculate UL as follows:

$$UL(1) = [(POROS - BR15) \times RD] \times 1/36$$
$$UL(2) = [(POROS - BR15) \times RD] \times 5/36$$
$$UL(3\text{-}7) = [(POROS - BR15) \times RD] \times 1/6$$

Example Given: RD = 24 inches, total porosity (POROS) = 0.41 in/in, and wilting point (BR15) = 0.08 in/in.

By this example, calculations would be--

$$\begin{aligned} UL(1) &= [(0.41 - 0.08) \times 24] \times 1/36 \\ &= 7.92 \times 1/36 \\ &= 0.22 \\ UL(2) &= 7.92 \times 5/36 \\ &= 1.10 \\ UL(3\text{-}7) &= 7.92 \times 1/6 \\ &= 1.32 \end{aligned}$$

and card 7 data would be as follows:

0.22 1.10 1.32 1.32 1.32 1.32 1.32

.7 Card 6, Option 2 There is no card 7 for option 2.

Card 6 DS, DP, GA, RMN, SLOPE, XLP

DS Depth (in) of surface soil layer (range of 0.2 to 2.0), e.g. 2.0

DP Depth (in) of maximum root growth layer, e.g. 22.0 (CRR 26, p. 504)

GA Effective capillary tension (in) of soil, e.g. 13.0; estimate from table A-6, page A-8. (CRR 26, p. 184)

RMN Manning's "n" for overland flow, e.g. 0.03; estimate from table B-2, page B-2. (CRR 26, p. 241 and 248)

SLOPE Effective hydrologic slope (ft/ft), e.g. 0.015; obtain value from field map. (CRR 26, p. 185)

XLP Effective hydrologic slope length (ft), e.g. 350.0; obtain value from field map. (CRR 26, p. 185)

3.8 Cards 8 to 14, Both Options

<u>Cards 8 and 9</u> TEMP(1-12)

TEMP() Average monthly temperatures (degrees F.), e.g. 45.0; obtain from climatological data summary.

<u>Cards 10 and 11</u> RADI(1-12)

RADI() Average monthly solar radiation values (langleys/day), e.g. 218.0; estimate from table A-7, page A-9. (CRR 26, p. 180-182)

<u>Card 12</u> GR

GR Winter cover factor to reflect soil evaporation; values range from 0.5 to 1.0. Use--

1.0 If soil is bare of crops in winter, because evaporation is high;

0.5 If soil is in continuous grass, pasture, small grains, or range, because evaporation is low.

Use a value interpolated from 0.5 to 1.0 to reflect residue remaining on field during winter. (CRR 26, p. 179)

<u>Card 13</u> LDATE, AREA, NOIRR

LDATE Date (Julian day), e.g. 001 (CRR 26, p. 183)

AREA Leaf area index for the crop or crops grown, e.g. 0.0; estimate from table A-8, page A-13. (CRR 26, p. 183)

NOIRR 0 (Or blank) for days when irrigation is not considered;
1 For days when irrigation is considered by the model.

The irrigation flag indicates when supplemental irrigation is to be considered. The flag assumes 100 percent delivery of water to the soil in root zone.

Note A card 13 is repeated as many times as necessary to define the leaf area index curve. The first card 13 must have the date 001; the last must have the date 366. The first date on the leaf area index curve is the planting date. See examples 1 and 2 on next page.

Example 1 For nonirrigated corn planted April 15 (day 105) and harvested September 15 (day 258),

growing season = 258 - 105 = 153.

Table A-8 distributes AREA values by increments of 0.1 of the growing season. For this example, each increment would be 15 days (0.1 x 153 = 15).

On the basis of AREA values for corn in table A-8, card 13's would appear as follows:

	LDATE	AREA	NOIRR
Card 13	001	0.00	0
Card 13	105	0.00	0
Card 13	120	0.09	0
Card 13	135	0.19	0
Card 13	150	0.23	0
Card 13	165	0.49	0
Card 13	180	1.16	0
Card 13	195	2.97	0
Card 13	210	3.00	0
Card 13	225	2.72	0
Card 13	240	1.83	0
Card 13	258	0.00	0
Card 13	366	0.00	0

Example 2 For irrigated soybeans planted May 1 (day 121) and harvested October 8 (day 281),

growing season = 281 - 121 = 160.

Irrigation is considered from planting date until 30 days before harvest (LDATE = 251).

Using table A-8, card 13's would appear as follows:

	LDATE	AREA	NOIRR
Card 13	001	0.00	0
Card 13	121	0.00	1
Card 13	137	0.15	1
Card 13	153	0.40	1
Card 13	169	2.18	1
Card 13	185	2.97	1
Card 13	201	3.00	1
Card 13	217	2.96	1
Card 13	233	2.92	1
Card 13	249	2.30	1
Card 13	251	2.16	0
Card 13	265	1.15	0
Card 13	281	0.50	0
Card 13	282	0.00	0
Card 13	366	0.00	0

Since LDATE of 251 is between the LDATES of 249 and 265, (the 0.8 and 0.9 increments of AREA), AREA for day 251 is interpolated as--

$$\frac{(251 - 249)}{(265 - 249)} \times (2.30 - 1.15) = 0.14375;$$

however, this result must be subtracted because the AREA is declining. Therefore:

$2.30 - 0.14375 = 2.15625$ (use 2.16)

<u>Card 14</u>

NEWT, NEWR, NEWL

NEWT	0	Use the temperatures from last year;
	1	Read a new set of temperatures (cards 8 and 9);
	-1	Stop program.
NEWR	0	Use the solar radiation values from last year;
	1	Read new solar radiation values (cards 10 and 11).
NEWL	0	Use the leaf area index from last year;
	1	Read a new set of leaf area index values (card 12 and a new set of card 13's).

<u>Notes on Cards 8 to 14</u>

Temperatures, solar radiation values, and leaf area index parameters can be updated at the end of each year. If they are to be updated, they will be read in the same sequence and format as the initial inputs. If the leaf area index is updated, the winter cover factor (GR, card 12) will be read.

A card 14 is read <u>after</u> each year of simulation. To stop the program, enter a negative value in NEWT. If any card 14 parameter is 1, insert the appropriate "NEW" data after that card 14. That is, insert cards 8 and 9 after NEWT, 10 and 11 after NEWR, and a card 12 and a set of 13's after NEWL. Use a card 14 for each year of simulation; that is, the number of card 14's corresponds to the number of years in the rainfall file.

In figure 3-5 (page 3-5), note that card 14 is repeated three times. The -1 value on the third card 14 stops the program at the end of the third year of simulation.

CHAPTER 4

EROSION AND SEDIMENT YIELD COMPONENT

The erosion/sediment component, which operates on the same watershed as the hydrology component, computes erosion, sediment yield, and particle composition of the sediment on a storm-by-storm basis.

The erosion/sediment component combines new modeling concepts with such commonly accepted relationships as the Universal Soil Loss Equation (USLE). The model operates on three types of surface runoff in this sequence: overland flow, concentrated (channel) flow, and flow from an impoundment. One, two, or all three elements may be present. Figure 4-1 illustrates the possible sequences.

The impoundment element is not to be used to simulate a farm pond. It can, however, simulate an impoundment that drains through an underground outlet between storms, such as pipe outlets from terraces and sediment control basins. It can also simulate water impounded behind field ridges and culverts if the discharge is controlled--for example, by a pipe outlet--and if the impoundment drains completely between storms or a discharge rating can be given.

To operate, the erosion/sediment component requires the hydrology pass file and the erosion/sediment parameter file. The hydrology pass file is routed from WCC and is stored in the Harris terminal or other local computer system from which the hydrology component was loaded. Section 4.1 describes the data in the pass file; figure 4-2 is a sample pass file. Sections 4.2 to 4.10 describe the erosion/sediment parameter file.

4.1 Hydrology Pass File

The hydrology pass file contains 13 parameters. This information is repeated for each rainfall event. The pass file is used as input to the erosion/sediment component.

Editing the Pass File

A hydrology pass file received from WCC must be edited by deleting the first two lines, so that its first valid line begins with a Julian date. The last record of the pass file should be a blank line.

Line Format

SDATE, RNFALL, RUNOFF, EXRAIN, EI, DP, PERCOL, AVGTMP, AVGSWC, ACCPEV, POTPEV, ACCSEV, POTSEV

SDATE Date of storm (Julian date), e.g. 73135

RNFALL Volume of rainfall (in), e.g. 4.42

RUNOFF Volume of runoff (in), e.g. 3.62

EXRAIN Characteristic excess rainfall rate (in/hr), e.g. 2.61

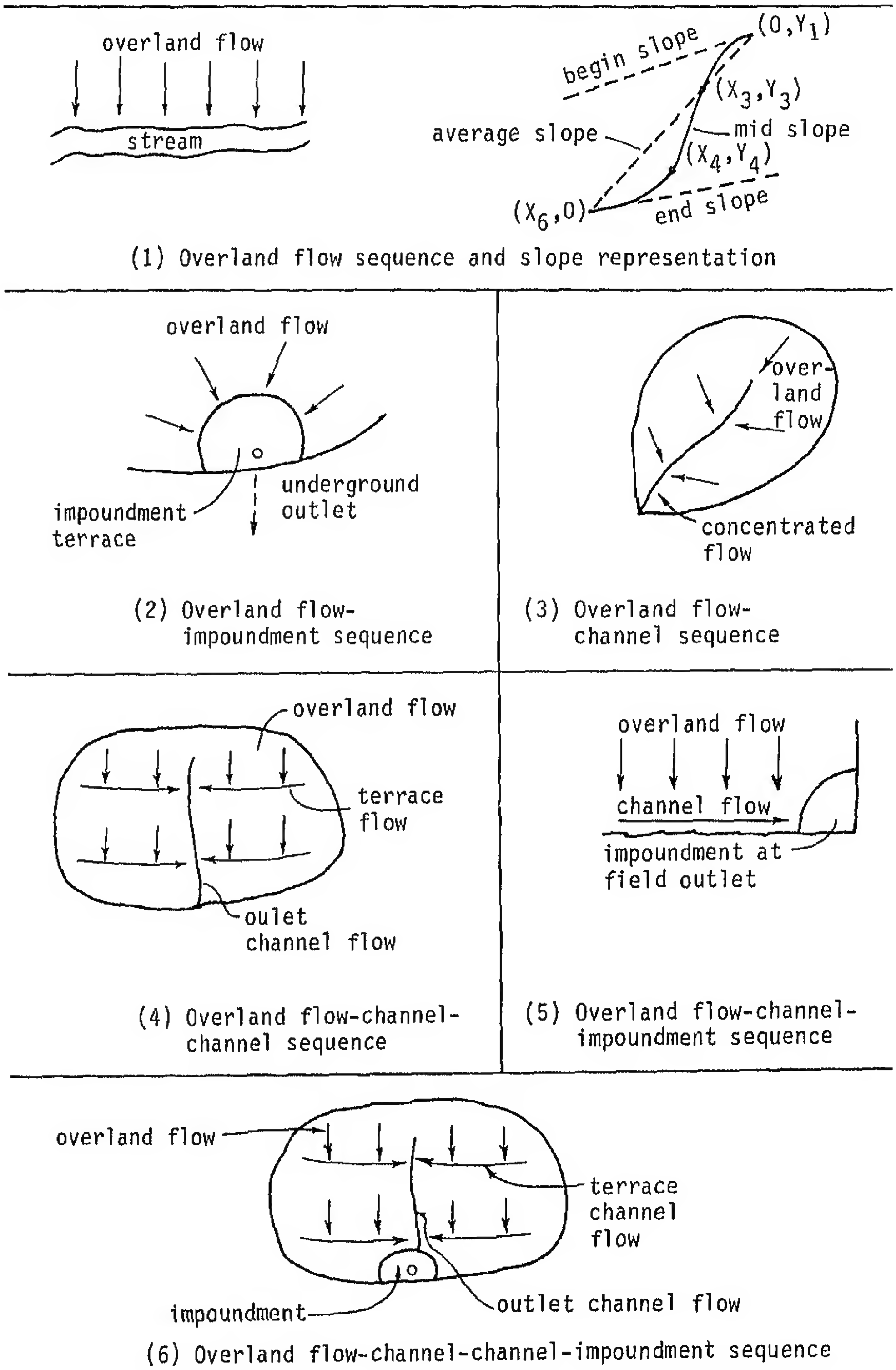


Figure 4-1.--Flow sequences for typical field systems in the erosion/sediment component.

EI Erosion index for the given storm, e.g. 69.21; based on Agriculture Handbook 537.

DP Number of days since the last storm when infiltration occurred, e.g. 1

PERCOL Percolation (in) below the root zone, e.g. 0.33

AVGTMP Average temperature (degrees F.) between storms, e.g. 73.2

AVGSWC Average soil water (in/in) between storms, e.g. 0.388

ACCPEV Actual transpiration from plants, EP (in), for the period between storms, e.g. 0.001

POTPEV Potential EP (in) for the period between storms, e.g. 0.001

ACCSEV Actual evaporation of water (in) from the soil (ES) for the period between storms, e.g. 0.254

POTSEV Potential ES (in) for the period between storms, e.g. 0.254

Note To compute actual evapotranspiration between storms, add ACCPEV and ACCSEV. To compute potential evapotranspiration between storms, add POTPEV and POTSEV.

Format(I6,F6.2,F6.2,F6.2,F6.2,I2,F6.2,F6.2,F6.3,F6.3,F6.3,F6.3,F6.3)

74135	4.42	3.62	2.61	69.21	1	0.33	73.20	0.388	0.001	0.001	0.254	0.254
74141	1.38	0.45	0.43	12.81	5	0.23	74.13	0.358	0.022	0.022	0.257	0.257
74142	1.66	1.14	0.96	16.92	1	0.25	75.04	0.387	0.007	0.007	0.257	0.257
74145	0.18	0.00	0.00	0.59	3	0.02	75.54	0.354	0.064	0.064	0.259	0.259

Figure 4-2.--Sample of a hydrology pass file. Above the columns are the data formats. Fields 1 and 6 are for integer data; the rest are 6-character fields of real numbers with two or three decimal places.

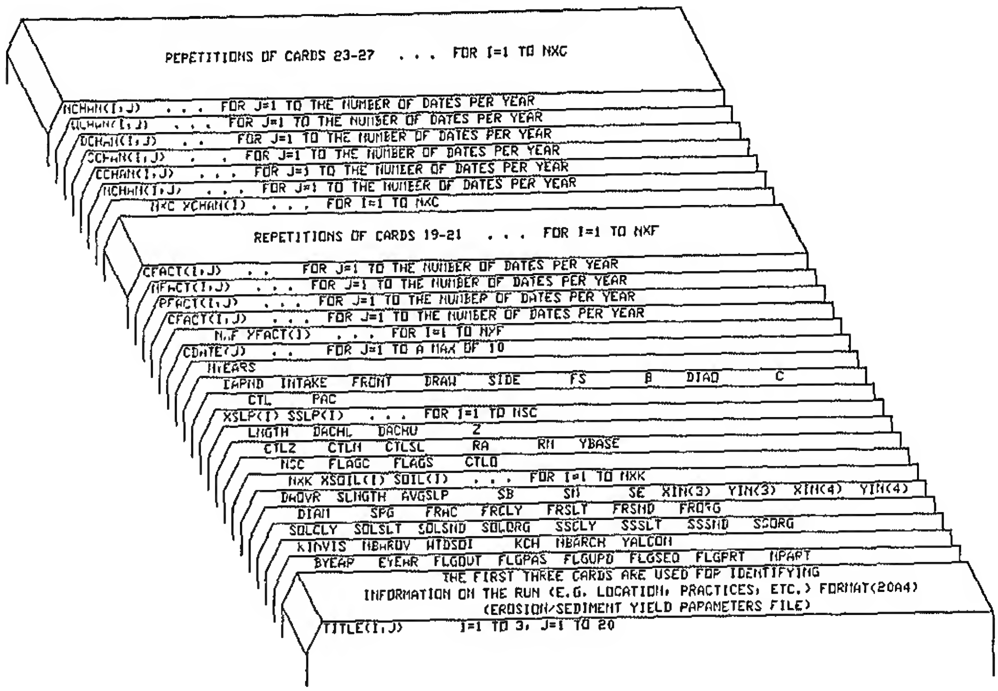


Figure 4-3.--Card deck arrangement for the erosion/sediment component.

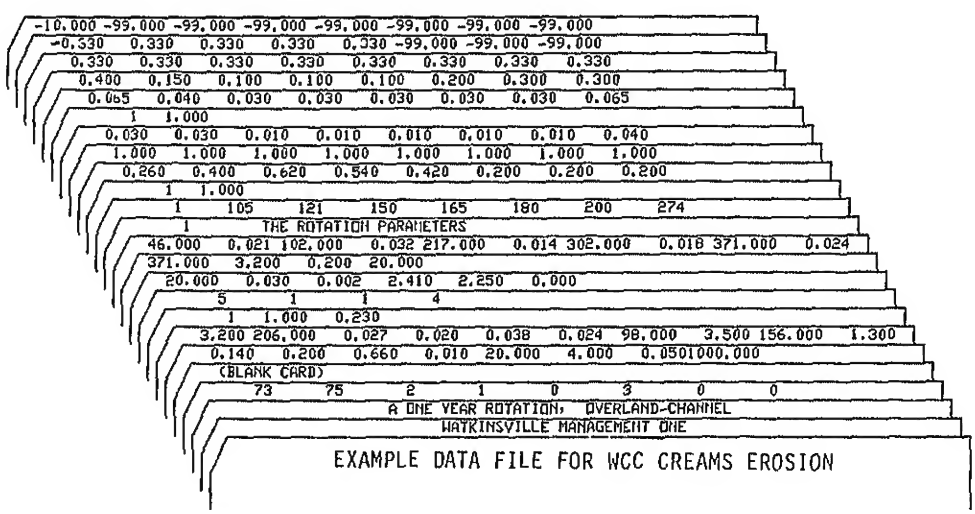


Figure 4-4.--Sample deck arrangement showing 3 years of erosion/sediment input data for watershed P2 in Watkinsville, Georgia.

4.2 Preparation of Input Files

This section discusses input formats and types of input parameters in the erosion/sediment parameter file.

Input Formats

Alphanumeric input in the erosion/sediment component has an A4 format. Unless stated otherwise in sections 4.4 to 4.10, all numeric input formats consist of 8-column fields. Integer data are read with I8 formats. Real numbers are read with F8.0 formats and must include a decimal-point value. The example value in each parameter description indicates whether it is an integer or a real number.

Figure 4-3 shows the card-deck arrangement of parameters. Figure 4-4 shows a deck with sample data values. In some instances, all or some entries on a card can be left blank if a default value is available and applicable.

Initial and Updatable Parameters

The model uses two types of parameters. Initial parameters (cards 1 to 15, sections 4.4 to 4.7) are constant throughout the model run. Other parameters (cards 16 to 27, sections 4.8 to 4.10) are updatable during the calendar year. For example, Mannings "n", soil loss ratio, and other factors can change with cultivation and cover during the year.

The input sequence of updatable parameters was designed to avoid unnecessary repetition of values for different parts of a crop rotation. The updatable parameters are input on an annual basis (January to December) for each year of the rotation until parameters for one full rotation are entered. The values can then be reused for as many as 20 years of simulation.

For example, suppose a farmer uses a 2-year rotation of cotton-winter wheat-soybeans for 6 years. This rotation is described by updatable parameters for 2 years. In year 1, cotton is planted and harvested and winter wheat is planted. In year 2, winter wheat is harvested and soybeans are planted and harvested. The updatable parameters for years 3 and 5 would be exactly the same as those for year 1, and years 4 and 6 would be the same as year 2.

If an entire simulation is for a single crop grown year after year, you need to input only 1 year of updatable parameters. These can be reused for the entire 20-year simulation.

If crops are not systematically rotated but conditions vary considerably from year to year, you can use a different set of updatable parameters for each year.

4.3 Erosion/ Sediment Parameters

For selected erosion/sediment parameters, table 4-1 provides sources and quality of estimates. Figure 4-5 illustrates the file structure of the erosion/sediment component.

Table 4-1.--Erosion/sediment component: Definitions, sources, and quality of estimates for selected parameters

Parameter	Definition	Source of estimate	Quality of estimate
KINVIS	Kinematic viscosity	Table B-1	Excellent; however, only parameter expressing temperature effect. Quality for expressing that effect unknown
NBAROV	Manning's "n" for overland flow over bare, smooth soil (fine seedbed)	Use default, 0.01	Good but subjective
WTDSOI	Weight density of soil mass	Soil survey and table B-3	Good
KCH	Soil erodibility factor for channel erosion	Use default value, estimate as 0.39 times KSOIL	Poor; may require calibration
NBARCH	Manning's "n" for channel flow over bare, smooth soil (fine seedbed)	Table B-5	Good but subjective
YALCON	Constant in Yalin sediment transport equation	CRR 26, p. 224	Good; supposedly fixed, but may require calibration
Sand, silt, clay (card 6).	Primary particle distribution of original soil mass	Soil survey, soil tests, experience, table B-4	Very good
Particle characteristics (card 7).	Sediment particle size class and density of particle	CRR 26 and soil survey information or table B-6	Good for most midwestern silt loam soils; unknown for most other soils
DAOVR	Overland flow area	Map	Very good
SLNGTH	Overland flow slope length	Maps, soil survey, field observation	Good, but problem of choosing representative length
AVGSLP	Average overland flow slope steepness	Maps, soil survey, field observation	Good, but problem of choosing representative slope

Table 4-1, continued.

Parameter	Definition	Source of estimate	Quality of estimate
SB	Slope at beginning of overland flow profile	Maps, soil survey, field observation	Good, but problem of choosing representative steepness
SM	Slope at middle of overland flow profile	Maps, soil survey, field observation	Good, but problem of choosing representative steepness
SE	Slope at end of flow profile	Maps, soil survey, field observation	Good, but problem of choosing representative steepness
XIN(3),YIN(3) XIN(4),YIN(4)	Coordinates of mid-uniform slope section	Maps, soil survey, field observation	Good, but problem of choosing representative section
KSOIL(I)	Soil erodibility factor	Soil series sheet, SCS technical guides, Agric. Handb. 537	Good, based on extensive plot data
FLAGC	Channel shape	Experience, field observation	Good but subjective
Outlet control CTLZ CTLN CTLSL RA RN YBASE	Outlet control parameters including channel width, side slope, longitudinal slope, Manning's "n", rating curve	Experience, field observation, CRR 26	Poor, highly subjective
LNGTH	Channel length	Map, field observation	Good, but can be quite subjective
DACHL	Area drained by channel	Map	Very good
DACHU	Area draining into upper end of channel	Map	Very good
Z	Channel sideslope	CRR 26, field observation, map	Fair to good
SSLP	Slope along channel	Map, field observation	Very good

Table. 4-1, continued.

Parameter	Definition	Source of estimate	Quality of estimate
DAPND	Drainage area above pond	Map	Excellent
INTAKE	Intake rate	Soil survey, experience	Good
FS, B	Coefficients for pond surface area vs. depth	Field survey, CRR 26, map	Excellent for field survey, good for other sources
DIAO	Diameter of orifice in outlet pipe	Design notes, observation, experience	Excellent or good, if based on experience
CFACT(I,J)	Soil loss ratio (rill-interrill erosion)	Agric. Handb. 537; tables B-7 to B-11	Good, based on extensive plot data
PFACT(I,J)	Contouring factor (rill-interrill erosion)	Agric. Handb. 537; table B-12	Poor; value poorly defined for individual storms
NFACT(I,J)	Manning's "n" for overland flow over a covered soil surface	Table B-2	Good, but subjective
NCHAN	Manning's "n" for channel	CRR 26, handbooks; NBARCH selected from same handbook; table B-5	Good, but subjective
CCHAN	Critical shear stress which erosion begins in channel	CRR 26, experience, table B-13	Poor, values not known for many agricultural soils and management effects not known
SCHAN	Depth to nonerodible layer at side of channel	CRR 26, experience, field observation	Poor, highly subjective
DCHAN	Depth to nonerodible layer in channel	CRR 26, experience, field observation	Fair, but subjective
WCHAN	Channel width	CRR 26, field observation, photo	Fair

CARD NO										
1	EXAMPLE DATA FILE FOR WCC CREAMS									
2	WATKINSVILLE MANAGEMENT ONE									
3	A 1-YEAR ROTATION, OVERLAND-CHANNEL									
4	73	75	2	1	0	3	0			
5										
6	0.14	0.20	0.66	0.01	20.0	4.0	0.05	1000.0		
8	3.2	206.0	0.0267	0.020	0.038	0.024	98.0	3.5	156.0	
9	1	1.0	0.23							
10	5	1	1	4						
11	20.0	0.03	0.002	2.410	2.25	0.0				
12	371.0	3.2	0.2	20.0						
13	46.0	0.021	102.0	0.032	217.0	0.014	302.0	0.018	371.0	0.
16	1	THE ROTATION PARAMETERS								
17	001	105	121	150	165	180	200	274		
18	1	1.0								
19	0.26	0.40	0.62	0.54	0.42	0.20	0.20	0.20		
20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
21	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.04		
22	1	1.0								
23	0.065	0.04	0.03	0.03	0.03	0.03	0.03	0.065		
24	0.40	0.15	0.10	0.10	0.10	0.20	0.30	0.30		
25	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33		
26	-0.33	0.33	0.33	0.33	0.33	-99.0	-99.0	-99.0		
27	-10.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0		

Figure 4-5.--Example of parameter file for the erosion/sedimen component.

4.4 Cards 1 to 7: Initial General Parameters

Cards 1 to 3 TITLE()

TITLE Three lines of 80 characters each for alphanumeric information that you want printed at the beginning of the output.

Card 4 — BYEAR, EYEAR, FLGOUT, FLGPAS, FLGUPD, FLGSEQ, FLGPRT, NPART

BYEAR — Last two digits of the year when simulation begins, e.g. 73

EYEAR — Last two digits of the year when simulation ends, e.g. 75

FLGOUT
- 0 For abbreviated annual summary output;
- 1 For detailed annual summary output;
- 2 For abbreviated monthly and annual summary output;
- 3 For detailed monthly and annual summary output;
- 4 For abbreviated storm-by-storm and summary output;
- 5 For detailed storm-by-storm and summary output;
- 6 For very detailed storm-by-storm output by segments and the detailed summary output. Caution: if FLGOUT = 6, the program can generate excessive output.

FLGPAS
- 0 If no erosion/sediment pass file is to be created for the chemical component;
- 1 If a pass file is to be created for the chemical component.

FLGUPD
- 0 If the initial annual parameter inputs are to be reused after the period of rotation is completed;
- 1 If a new set of annual parameter inputs is to be read after the initial period of rotation is completed. See card 16 description (page 4-24).

FLGSEQ — This flag indicates the execution sequence of erosion/sediment submodels as follows:
- 1 Overland;
- 2 Overland-impoundment;
- 3 Overland-channel;
- 4 Overland-channel-channel;
- 5 Overland-channel-impoundment;
- 6 Overland-channel-channel-impoundment.

FLGSEQ determines whether certain groups of cards are read. Cards 8 and 9 are always read once. Cards 10 to 13 are read only if FLGSEQ is 3 or greater; they are repeated for a second channel if FLGSEQ is 4 or 6. Cards 14 and 15 are read only if FLGSEQ is 2, 5, or 6, and they are only read once. See figure 4-1 (page 4-2) for diagrams of the six FLGSEQ sequences.

specifications (sediment) are to be
el using default values;
cifications (sediment) are to be
be specified.

ypes (sediment) to be read in,
f particle types is 20.

Card 5 KINVIS, NBAROV, WTDSOI, KCH, NBARCH, YALCON

Default (model-inserted) values are available for these six parameters. If use of a default value is appropriate, leave that position on the card blank. If all six defaults are to be used, insert a blank card.

KINVIS Kinematic viscosity (ft^2/sec), default 1.21E-05 for 60° F water; estimate from table B-1. (CRR 26, p. 223)

NBAROV Manning's "n" for overland flow over bare soil, default 0.01; this should be the minimum value used during simulation. (CRR 26, p. 223)

WTDSOI Weight density of soil (lb/ft^3), default 96.0; estimate from table B-3, page B-3, or use B-horizon value on SOILS-5. (CRR 26, p. 223)

KCH Soil erodibility for erosion by concentrated flow in a channel ($(lb/ft^2/sec)(ft^2/lb)^{1.05}$), default 0.135; estimate by multiplying 0.39 times K (soil erodibility factor from soil series sheet). (CRR 26, p. 223)

NBARCH Manning's "n" for channel flow over bare soil, default 0.03 or estimate from table B-5, page B-4. The default should be the minimum value used. (CRR 26, p. 224)

YALCON Yalin constant for sediment transport, default 0.635 (CRR 26, p. 224)

Card 6 SOLCLY, SOLSLT, SOLSND, SOLORG, SSCLY, SSSLT, SSSND, SSORG

The fractions of clay (SOLCLY), silt (SOLSLT), and sand (SOLSND) should total 1.0. Organic matter (SOLORG) is a fraction of the soil mass. Complete the entire card 6.

SOLCLY Fraction of clay in the surface soil layer exposed to erosion, e.g. 0.14; estimate from table B-4, page B-3. (CRR 26, p. 225)

SOLSLT Fraction of silt in the surface soil layer exposed to erosion, e.g. 0.20; estimate from table B-4. (CRR 26, p. 225)

SOLSND Fraction of sand in the surface soil layer exposed to erosion, e.g. 0.66; estimate from table B-4. (CRR 26, p. 225)

SOLORG — Fraction of organic matter in the surface soil layer exposed to erosion, e.g. 0.01; obtain value from SOILS-5 sheet. If organic carbon fraction is known, you can multiply it by 1.73 to obtain SOLORG. (CRR 26, p. 225)

SSCLY — Specific surface area of clay particles (m^2/g of soil); suggested value is 20.0 for kaolinite and 800.0 for montmorillonite. (CRR 26, p. 227)

SSSLT — Specific surface area of silt particles (m^2/g of soil); suggested value, 4.0 (CRR 26, p. 227)

SSSND — Specific surface area of sand particles (m^2/g of soil); suggested value, 0.05 (CRR 26, p. 227)

SSORG — Specific surface area of organic matter (m^2/g of organic carbon); suggested value 1000.0 (CRR 26, p. 227)

Card 7 — DIAM, SPG, FRAC, FRCLY, FRSLT, FRSND, FRORG

If, on card 4, FLGPRT = 0, no card 7 is read and the number of particle types (NPART, card 4) is calculated. (CRR 26, p. 226) Repeat card 7 for each particle type (NPART); obtain estimates from table B-6, page B-5.

The sum of the fractions for clay, silt, and sand for each particle must equal 1.0; organic matter is a fraction of the total sediment mass.

DIAM — Particle diameter (mm), e.g. 0.030

SPG — Specific gravity (g/cm^3) of particle, e.g. 2.65

FRAC — Fraction of detached sediment that has the specified DIAM and SPG values, e.g. 0.50

FRCLY — Clay fraction of sediment particle, e.g. 0.3

FRSLT — Silt fraction of sediment particle, e.g. 0.5

FRSND — Sand fraction of sediment particle, e.g. 0.2

FRORG — Organic matter fraction of sediment particle, e.g. 0.02

4.5 Cards 8 and 9: Initial Overland Flow Parameters

Card 8 — DAOVR, SLNGTH, AVGSLP, SB, SM, SE, XIN(3), YIN(3), XIN(4), YIN(4)

Develop contour maps of the field and typical overland profile plot before completing cards 8 and 9.

DAOVR — Area (acres) represented by overland flow profile, e.g. 3.2; obtain from map. This is usually the area draining into the first channel or the impoundment. (CRR 26, p. 228)

SLNGTH — Slope length (ft) of representative overland flow profile, e.g. 206.0; this is a horizontal measurement--not a measurement made along the sloping ground surface. (CRR 26, p. 228)

AVGSLP — Average slope (ft/ft) of representative overland flow profile, e.g. 0.0267 (CRR 26, p. 230)

SB — Slope (ft/ft) at the upper end of profile, e.g. 0.020 (CRR 26, p. 231)

SM — Slope (ft/ft) of mid-section, e.g. 0.038 (CRR 26, p. 231)

SE — Slope (ft/ft) at the lower end of profile, e.g. 0.024 (CRR 26, p. 231)

XIN(3) — Horizontal distance (ft) from top of slope to the point where the uphill end of the mid-uniform section begins, e.g. 98.0 (CRR 26, p. 231)

YIN(3) — Elevation (ft) of the point at the uphill end of the mid-uniform section, e.g. 3.5 (CRR 26, p. 231)

XIN(4) — Horizontal distance (ft) from top of slope to the point above the downhill end of mid-uniform section, 156.0 (CRR 26, p. 231)

YIN(4) — Elevation (ft) of the point at the downhill end of mid-uniform section, e.g. 1.3 (CRR 26, p. 231)

Comments on Slope Shapes

Field profiles occur in a variety of shapes. Figure 4-6 shows slope shapes that can be analyzed. Figure 4-7 presents numerical relationships of the parameters for several kinds of slopes.

The elements of slope profile that the model uses to represent the actual field profile are identified in the complex convex-concave, simple concave, simple convex, and simple uniform slopes in figure 4-6. Read from left to right to identify slope elements and to name a slope. A slope is complex if it has convex and concave elements. Assign values one at a time to each variable to describe slope shape.

In the coordinate system, x (slope length) = 0 at the origin of overland flow, where y = maximum elevation. Where x = maximum slope length, y = 0.

If a midsection exists, its coordinates (XIN and YIN parameters must be determined. However, if a convex-concave slope has no mid-uniform section (SM), the point where the two curves meet has the same coordinates as the low end of the convex portion and the high end of the concave portion. The slope at this point is specified as SM, the tangent at this point. For a simple slope that has a mid-uniform segment, coordinates of the midsection are those at the upper and lower ends of the mid-uniform segment. If a simple slope has no mid-uniform section, the XIN and YIN coordinates are set equal to the coordinates of the end of the slope; that is, x = slope length and y = 0.

SB — SB is the slope of the upper end of the uniform segment. If the uniform segment does not exist, SB is the tangent slope at x = 0.

SM — SM is the slope of the mid-uniform segment. If no mid-uniform section exists, SM equals the tangent slope of the land profile where the upper and lower sections meet. On a simple convex or concave slope, SM is the slope of the land profile at x = slope length.

SE — SE is the slope of the lower end of the profile. That is, SE is the slope where x = slope length.

On uniform slopes, SB = SM = SE. On simple concave or convex slopes, SM = SE. On convex (simple or complex) slopes, SM is <u>greater</u> than the average slope.

On concave (simple and complex) slopes, SM is less than the average slope. The upper slope, SB, is less than the average slope on convex slopes and is greater than the average slope for concave slopes.

On complex convex-concave slopes, SE is less than the average slope. On complex concave-convex slopes, SE is greater than the average slope.

If these conditions are not met, the program may fail. For example, failure may occur as division by zero or as the raising of a negative number to a power.

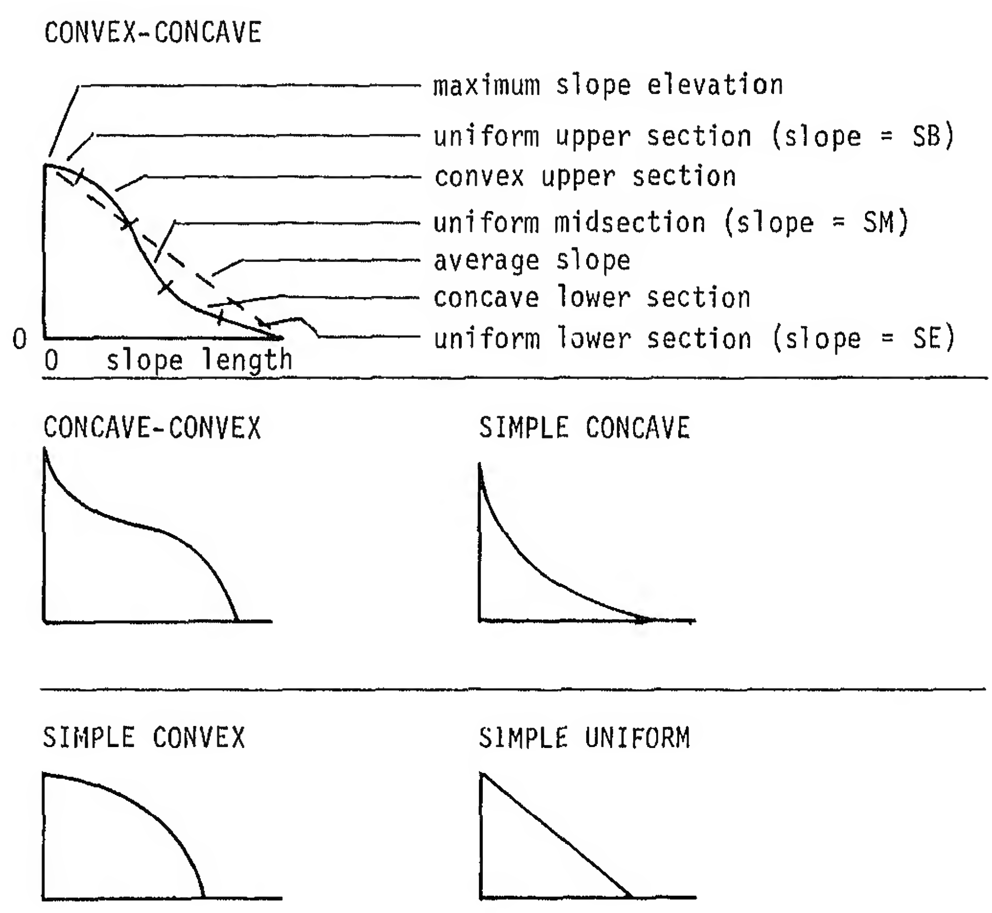
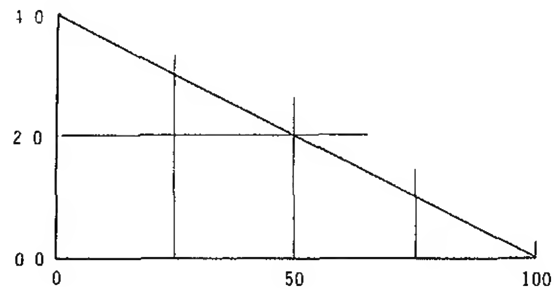


Figure 4-6.--Slope shapes that can be analyzed by the erosion/sediment yield component.

A SIMPLE UNIFORM

All elevations should be in relation to the lowest point on the overland flow profile, which is set at 0.0.



SLNGTH = 100.0

$AVGSLP = \frac{4.0}{100.0} = 0.04$

SB = SM = SE = AVGSLP

SB = 0.04

SM = 0.04

SE = 0.04

XIN(3) = XIN(4) = SLNGTH

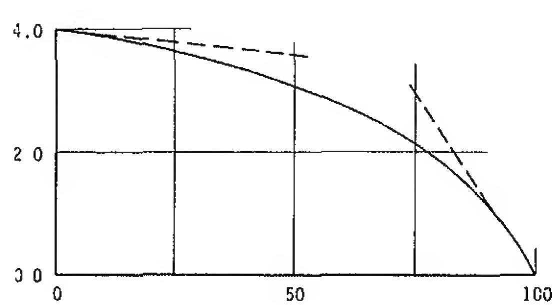
XIN(3) = 100.0

YIN(3) = 0.0

XIN(4) = 100.0

YIN(4) = 0.0

B SIMPLE CONVEX



SLNGTH = 100.0

$AVGSLP = \frac{4.0}{100.0} = 0.04$

$SB = \frac{0.4}{50.0} = 0.008$

$SM = SE = \frac{3}{25} = 0.12$

XIN(3) = XIN(4) = SLNGTH

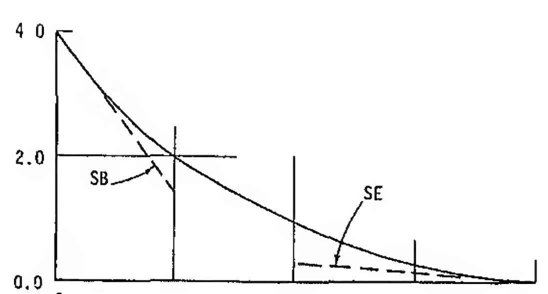
XIN(3) = 100.0

YIN(3) = 0.0

XIN(4) = 100.0

YIN(4) = 0.0

C SIMPLE CONCAVE



SLNGTH = 100.0

$AVGSLP = \frac{4.0}{100.0} = 0.04$

$SB = \frac{2.6}{25} = 0.10$

$SM = SE = \frac{0.3}{25} = 0.006$

XIN(3) = XIN(4) = SLNGTH

XIN(3) = 100.0

YIN(3) = 0.0

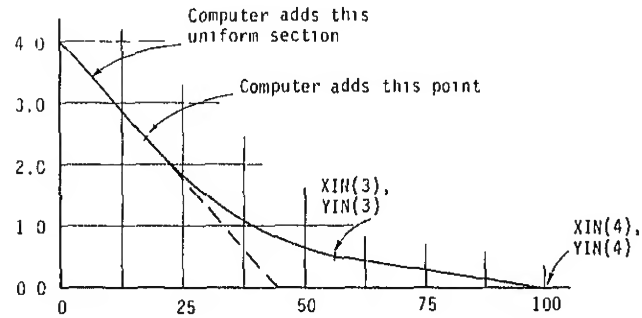
XIN(4) = 100.0

YIN(4) = 0.0

Figure 4-7.--Numerical illustration of various slopes.

D UNIFORM-CONCAVE-UNIFORM

Simple concave with straight (midsection) at lower end.



SLNGTH = 100.0

$AVGSLP = \frac{4.0}{100.0} = 0.04$

$SB = \frac{4.0}{43} = 0.093$

Compute SM from XIN(3),YIN(3) and XIN(4),YIN(4).

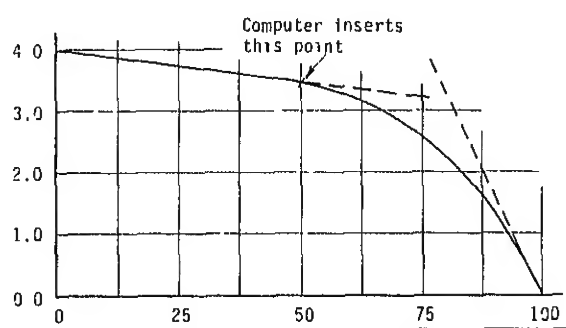
XIN(3) = 56.0
YIN(3) = 0.5
XIN(4) = 100.0
YIN(4) = 0.0

$SM = \frac{0.5 - 0.0}{100.0 - 56.0} = 0.011$

SE = SM = 0.011

E UNIFORM-CONVEX

Concave with computer-added straight section of upper end. Treat input the same as for a simple concave slope; computer will do the remainder.



SLNGTH = 100.0

$AVGSLP = \frac{4.0}{100.0} = 0.04$

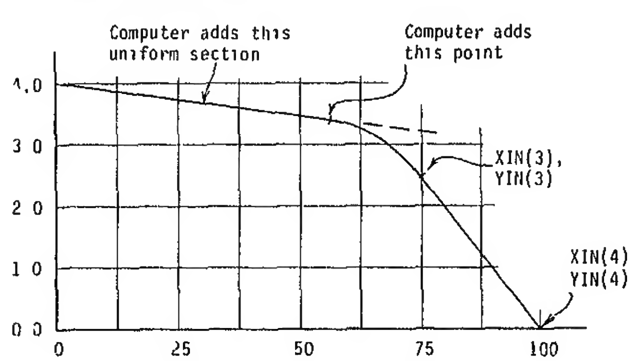
$SB = \frac{0.8}{75} = 0.011$

$SM = SE = \frac{4.1}{25} = 0.164$

XIN(3) = XIN(4) = SLNGTH = 100.0
YIN(3) = YIN(4) = 0.0

F UNIFORM-CONVEX-UNIFORM

Convex with straight (midsection) added at lower end. Computer automatically adds straight section of upper end



SLNGTH = 100.0

AVGSLP = 0.04

$SB = \frac{0.8}{75} = 0.011$

Compute SM from XIN(3),YIN(3) and XIN(4),YIN(4).

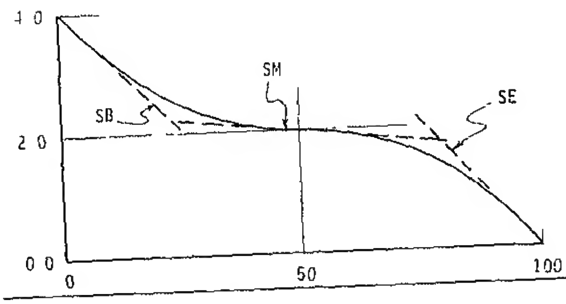
XIN(3) = 75.0
YIN(3) = 2.5
XIN(4) = 100.0
YIN(4) = 0.0

$SM = \frac{2.5 - 0.0}{100.0 - 75.0} = 0.10$

SE = SM = 0.10

Figure 4-7, <u>continued</u>.--Numerical illustration of various slopes.

G CONCAVE-CONVEX



SLNGTH = 100.0

$$AVGSLP = \frac{4\ 0}{100.0} = 0\ 04$$

$$SB = \frac{1\ 8}{25} = 0.07$$

$$SM = \frac{2.1 - 1.9}{62.5 - 37\ 5} = 0.008$$

$$SE = \frac{2\ 1}{25} = 0\ 08$$

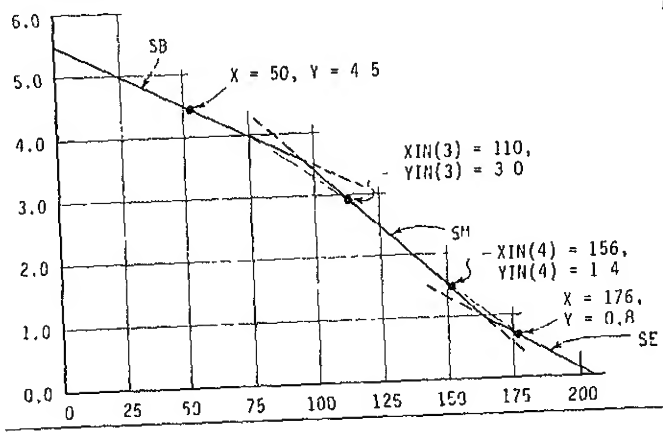
XIN(3) = 37 5

YIN(3) = 2 1

XIN(4) = 62 5

YIN(4) = 1 9

H CONVEX-CONCAVE



SLNGTH = 206.0

$$AVGSLP = \frac{5\ 5}{206.0} = 0.027$$

$$SB = \frac{5\ 5 - 4\ 5}{50} = 0.02$$

$$SM = \frac{3\ 0 - 1.4}{156 - 110} = 0.035$$

$$SE = \frac{0.8 - 0\ 0}{206 - 176} = 0.027$$

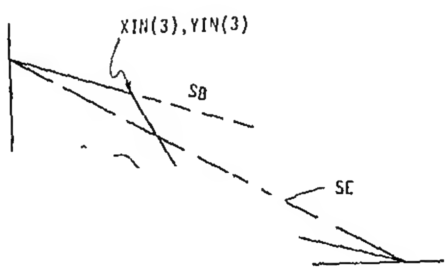
XIN(3) = 110.0

YIN(3) = 3.0

XIN(4) = 156.0

YIN(4) = 1.4

I. NOT PERMITTED



XIN(3),YIN(3) cannot be at the intersection of the SB and SM lines.

XIN(4),YIN(4) cannot be at the intersection of the SM and SE lines

XIN(3) must be downslope from the intersection of SB and SM, and XIN(4) must be upslope from the intersection of SM and SE

Numerical illustration of various slopes

Card 9 NXK, XSOIL(I), KSOIL(I), for I = 1 to NXK

NXK Number (1 to 5) of slope segments differentiated by changes in soil erodibility factor, e.g. 1 (CRR 26, p. 231)

XSOIL(I) Relative horizontal distance (ft) from the top of the slope to the bottom of segment I, e.g. 1.0

KSOIL(I) Soil erodibility factor (ton/acre per English EI) for slope segment just above XSOIL(I), e.g. 0.23; obtain value from SOILS-5 or field map.

Example Assume a horizontal slope length of 200 feet, K = 0.4 ton/acre per EI for the first 150 feet (measuring from the top of slope), and K = 0.2 ton/acre per EI for the last 50 feet. The card 9 would be--

2 0.75 0.4 1.0 0.2

6 Cards 10 to 13: Initial Channel Parameters

Develop a channel profile and cross-section plot before completing this section. Whether the following cards are read depends on the execution sequence (FLGSEQ, card 4). They are not used if FLGSEQ = 1 or 2; they are repeated if FLGSEQ = 4 or 6.

Card 10 NSC, FLAGC, FLAGS, CTLO

NSC Number of channel segments differentiated by changes in slope, e.g. 5 (maximum of 5)

FLAGC This flag indicates channel shape (see CRR 26, p. 242):
1 Triangular channel;
2 Rectangular channel;
3 Naturally eroded channel.

FLAGS
1 If the program is to calculate the slope of the energy gradeline (friction slope);
2 If the program is to assume that the friction slope equals the channel slope. See table B-15, page B-20, for guidelines. (CRR 26, p. 243)

CTLO
1 If critical depth controls depth at the end of the field channel;
2 If uniform flow controls depth at the end of the field channel (each channel has its own unique characteristics);
3 Same as 2, except Manning's "n" for the outlet channel is the same as that for the lower segment of the field channel;
4 If a rating curve controls depth at the end of the field channel.

Critical discharge (Q) is computed as follows:

$$Q = RA \times (Y - YBASE)^{RN}$$

where
Q = critical flow discharge, ft^3/s;
RA = coefficient (see card 11);
Y = flow depth
YBASE= minimum depth (ft) for flow to begin (see card 11);
RN = exponent (see card 11).

Card 11 — CTLZ, CTLN, CTLSL, RA, RN, YBASE

CTLZ — Side slope of a cross-section of the outlet control channel, expressed as a ratio of horizontal to vertical, e.g. 20.0 (CRR 26, p. 245)

CTLN — Manning's "n" for the outlet control channel, e.g. 0.030; see table B-5, page B-4.

CTLSL — Slope (ft/ft) of the outlet control channel, e.g. 0.002

RA — Coefficient in the rating curve equation e.g. 2.4 (CRR 26, p. 244)

RN — Exponent in the rating curve equation, e.g. 2.25 (CRR 26, p. 244)

YBASE — Minimum depth (ft) for flow to begin, e.g. 0.0 (CRR 26, p. 244)

Note — If CTLO (card 10) = 1, 2, or 3, leave variables RA, RN, and YBASE blank.

Card 12 — LNGTH, DACHL, DACHU, Z

LNGTH — Channel length (ft), e.g. 371.0 (CRR 26, p. 244)

DACHL — Total drainage area (acres) at lower end of channel segment, e.g. 3.2; see figure 4-8 (CRR 26, p. 244)

DACHU — Drainage area (acres) above upper end of channel segment, e.g. 0.2 (CRR 26, p. 244)

Z — Side slope (ft/ft) of channel cross-section, expressed as a ratio of horizontal to vertical distance, e.g. 20.0

If FLAGC = 2 or 3 (card 10), enter the value for Z that most closely approximates the channel shape. (CRR 26, p. 245)

Card 13 XSLP(I), SSLP(I) for I = 1 to NSC (card 10, channel slopes)

XSLP(I) Distance (ft) from upper end of the channel to the bottom of segment I, e.g. 46.0; see example, figure 4-9.

SSLP(I) Slope of segment directly above XSLP(I), e.g. 0.021; see example, figure 4-9.

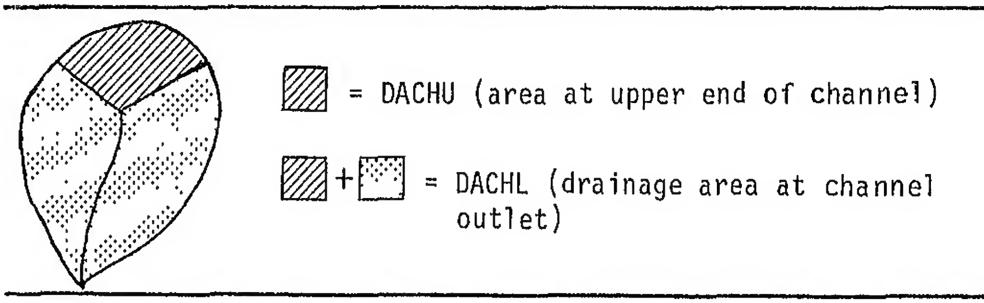


Figure 4-8.--Relationship of DACHU and DACHL parameters to channel area (main flow concentration).

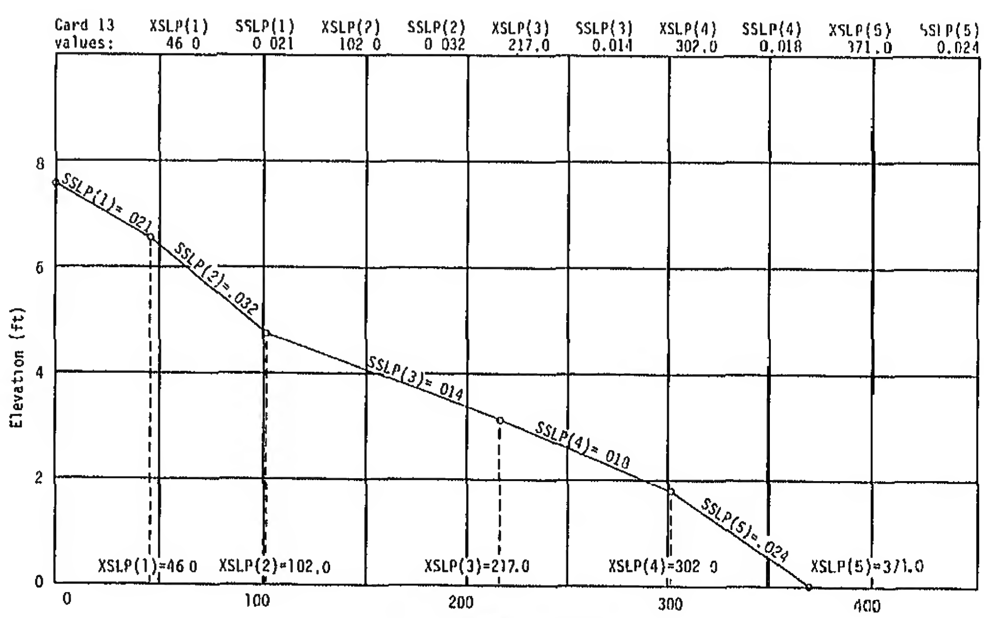


Figure 4-9.--Example of channel profile and parameter values for card 13.

4.7 Cards 14 and 15: Impoundment Parameters

Skip cards 14 and 15 if FLGSEQ = 1, 3, or 4 (card 4).

Card 14 — CTL, PAC

CTL
- 1 If the pipe outlet control is typical of impoundment type terraces;
- 2 If an orifice coefficient (C, card 15) is to be entered. (CRR 26, p. 252)

PAC
- 1 If the program is to calculate coefficients for the surface area-depth relationship on the basis of user-supplied parameters for the impoundment basin slopes;
- 2 If the FS and B values (card 15) are known for the following equation:

$$SA = FS(Y^{B})$$

where SA = surface area (ft^2) and Y = depth (ft).

Card 15 — DAPND, INTAKE, FRONT, DRAW, SIDE, FS, B, DIAO, C

DAPND — Total drainage area (acres) above the impoundment, e.g. 3.2 (CRR 26, p. 252)

INTAKE — Saturated soil water intake rate (in/hr) or saturated conductivity within the impoundment, e.g. 0.2 (CRR 26, p. 253)

FRONT — Embankment front slope (vertical to horizontal, ft/ft), e.g. 0.2; FRONT value is needed only if PAC = 1 (card 14). For terraces and impoundments, respectively, figures 4-10 and 4-11 show the topographic relationship of the parameters FRONT, DRAW, SIDE.

DRAW — Slope (vertical to horizontal, ft/ft) along channel draining into impoundment, e.g. 0.024; DRAW value is needed only if PAC = 1 (card 14). See figures 4-10 and 4-11.

SIDE — Side slope (vertical to horizontal, ft/ft) of land at impoundment toward DRAW, e.g. 0.01; SIDE value is needed only if PAC = 1 (card 14). See figures 4-10 and 4-11.

FS — Coefficient in the surface area-depth relationship, e.g. 9500.0; needed only if PAC = 2 (card 14). (CRR 26, p. 252)

B — Exponent in the surface area-depth relationship, e.g. 1.73; needed only if PAC = 2 (card 14). (CRR 26, p. 252)

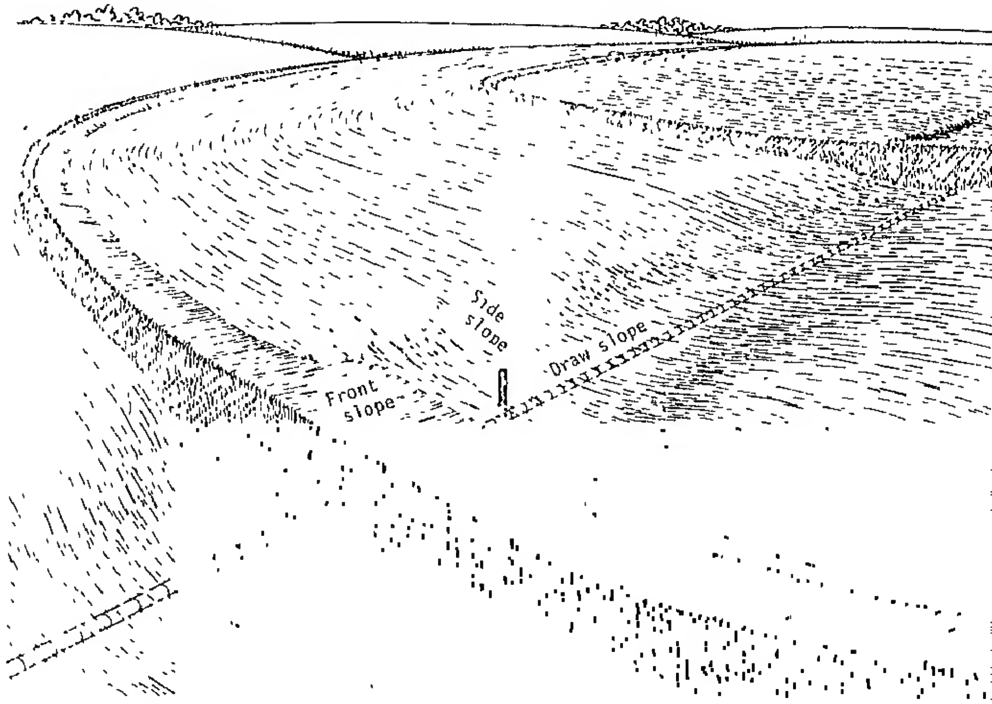


Figure 4-10.--Typical terrace system with pipe outlets: relationship of topography to FRONT, DRAW, and SIDE parameters.

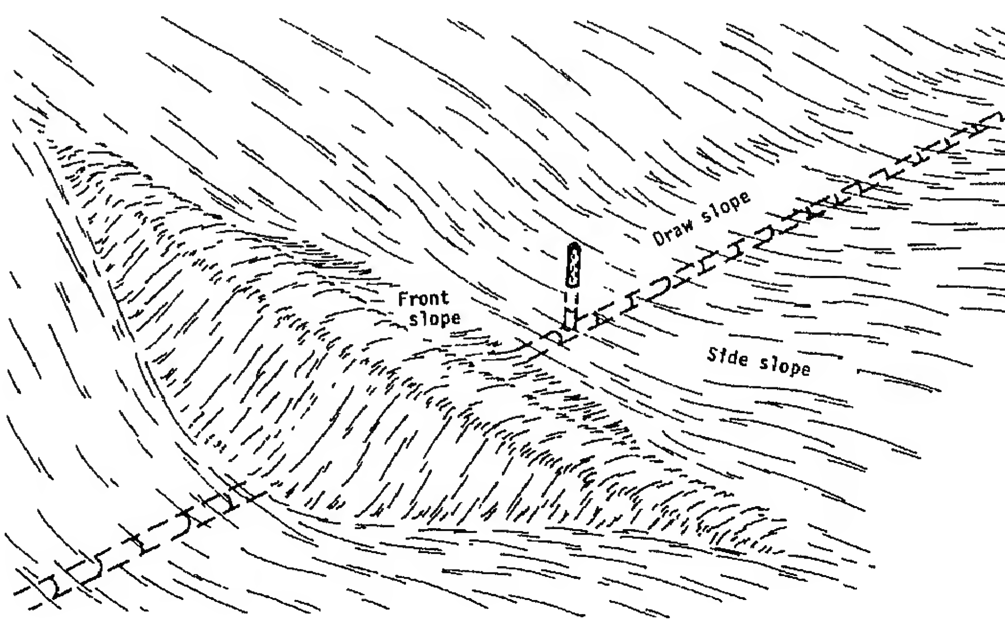


Figure 4-11.--Typical impoundment for water and sediment cont basin: relationship of topography to FRONT, DRAW, and S parameters.

DIAO Diameter (in) of pipe orifice, e.g. 3.0; needed only if CTL = 1 (card 14). (CRR 26, p. 253)

C Orifice coefficient, e.g. 3000.0; needed only if CTL = 2 (card 14). (CRR 26, p. 253)

The equation for C is

$$C = 3600\ Q/Y^{\frac{1}{2}}$$

where

Q = peak discharge of pipe at outlet (ft^3/s), and

Y = depth (ft) of water above control orifice.

Use figures B-5 and B-6 (pages B-21 and B-22) to obtain values for Q and Y.

4.8 Cards 16 and 17: Updatable General Parameters

The remaining inputs, cards 16 to 27, are updatable and date dependent. The program checks FLGUPD (card 4) to determine whether to read a new set of updatable parameters or to reuse the original set after a period of rotation (NYEARS, card 16) is completed. The execution sequence flag (FLGSEQ, card 4) determines the sequence in which cards 16 to 27 are read.

There are no updatable parameters for an impoundment. The updatable overland flow parameters are on cards 18 to 21, and the updatable channel parameters are on cards 22 to 27. See chapter 6 for example of the sequential card order.

Card 16 NYEARS

NYEARS The number of years in this rotation, e.g. 1

Card 17 CDATE(J) for J = 1 to 10

CDATE The days (Julian) on which sets of parameters take effect, e.g. 001, 105, etc.

The first CDATE should be 001 for the first year of rotation. CDATEs for subsequent years do not have to start with 001.

Notes The computer reads all 10 data fields on card 17 but uses only values greater than zero. If, for example, only five CDATES are to be used in a year (J = 5), enter them on the first five fields of the card and leave the last five fields blank.

Use one card 17 for each year of updatable parameter inputs (NYEARS, card 16). Each card can have up to 10 dates. The maximum number of CDATES you can use in a total rotation is 30. You can spread them out using 3 per year over 10 years, 10 per year over a 3-year simulation, or any combination

between these. Each year in a rotation does not require the same number of dates.

Card 16 and an appropriate number of card 17's must always be the first cards in a set of updatable parameter inputs. If FLGUPD = 1, the new set of updatable parameter inputs must have a card 16 and an appropriate number of card 17's. See chapter 6 for an example of the erosion/sediment data file.

4.9 Cards 18 to 21: Updatable Overland Flow Parameters

Card 18 is read on the initial pass through the program, but not in subsequent reads of updatable parameters. This means that the XFACTs you initially enter will be the same for every year in the rotation.

<u>Card 18</u> — NXF, XFACT(I) for I = 1 to NXF

NXF — Number (1 to 9) of overland flow profile segments differentiated by changes in the overland annual parameters, e.g. 1

XFACT(I) — Relative horizontal distance (ratio of distance over total distance) from top of overland flow profile to the bottom of segment I, e.g. 1.0

<u>Card 19</u> — CFACT(I,J) for J = 1 to the number of dates per year

CFACT(I,J) — Soil loss ratio for overland flow profile segment just above XFACT(I), e.g. 0.26; see tables B-7 to B-11, pages B-6 to B-17. (CRR 26, p. 230)

<u>Card 20</u> — PFACT(I,J) for J = 1 to the number of dates per year

PFACT(I,J) — Contouring factor for overland flow profile segment just above XFACT(I), e.g. 1.0; see table B-12, page B-18. (CRR 26, p. 239)

<u>Card 21</u> — NFACT(I,J) for J = 1 to the number of dates per year

NFACT(I,J) — Manning's "n" for overland flow profile segment just above XFACT(I), e.g. 0.03; see table B-2, page B-2. NFACT (I,J) must be no less than NBAROV (card 5).

Note — A set of cards 19 to 21 is repeated for each of the I number of XFACTs (I = 1 to NXF, card 18). Similarly, a set of cards 19 to 21 is repeated for each year (NYEARS, card 16) in the rotation. All cards 19 to 21 are read before cards 22 to 27.

4.10 Cards 22 to 27: Updatable Channel Parameters

Card 22 is read on the initial pass through the program, but not in subsequent reads of annual channel parameters. This means that the XCHANs you initially enter will be the same for every year in the rotation.

<u>Card 22</u> — NXC, XCHAN(I) for I = 1 to NXC

NXC — Number (1 to 9) of channel profile segments differentiated by changes in the channel parameters, e.g. 1

XCHAN(I) — Relative horizontal distance from top of channel to the the bottom of segment I, e.g. 1.0

<u>Card 23</u> — NCHAN(I,J) for J = 1 to the number of dates per year

NCHAN(I,J) — Manning's "n" for channel profile segment just above XCHAN(I), e.g. 0.065; see table B-5, page B-4. NCHAN(I,J) must be no less than NBARCH (card 5). (CRR 26, p. 247)

<u>Card 24</u> — CCHAN(I,J) for J = 1 to the number of dates per year

CCHAN(I,J) — Critical shear stress (lb/ft^2) for channel profile segment just above XCHAN(I), e.g. 0.4; see table B-13, page B-19. (CRR 26, p. 247)

<u>Card 25</u> — SCHAN(I,J) for J = 1 to the number of dates per year

SCHAN(I,J) — Depth (ft) to the nonerodible layer along the channel side in the channel profile segment just above XCHAN(I), e.g. 0.33; see figure 4-12. (CRR 26, p. 251)

<u>Card 26</u> — DCHAN(I,J) for J = 1 to the number of dates per year

DCHAN(I,J) — Depth (ft) to the nonerodible layer in the channel middle, for the channel profile segment just above XCHAN(I), e.g. 0.33; see figure 4-12.

<u>Card 27</u> — WCHAN(I,J) for J = 1 to the number of dates per year

WCHAN(I,J) — Top width (ft) of the channel for the channel profile segment just above XCHAN(I), (ft), e.g. 10.0; if FLAGC = 1 or 3 (card 10), enter the WCHAN value that most closely approximates the channel shape.

<u>Notes</u> — A set of cards 23 to 27 is repeated for each I number of XCHANs (I = 1 to NXC, card 22). Similarly, a group of such sets of cards 23 to 27 is repeated for each year (NYEARS, card 16) in the rotation. Refer to table B-14 (page B-20) for example of changes along channel.

For the second channel, one set of cards 22 to 27 is required, and a set of cards 23 to 27 is repeated for each I number of XCHANs (I = 1 to NXC, card 22). A group of sets of cards 23 to 27 is repeated for each year in the rotation.

The parameters on cards 26 and 27 have a feature none of the other parameters has: if you assign any of them a negative value--with one important exception described in the next paragraph--the computer program will use the computed value for DCHAN or WCHAN. For example, in figure 4-5 (page 4-9), the -99.0 value on card 26 tells the computer program to use the simulated values for DCHAN rather than be constrained to 0.33 foot. Where a positive 0.33 is shown, it informs the program that cultivation has occurred and depth to nonerodible layer or plowpan is 0.33 foot or 4 inches. The -99.0 was selected to give its negative status more prominence; a -1.0 would serve just as well.

With one exception, negative numbers on cards 26 and 27 have no computation value. The exception occurs in the first pass through the annual values; the program reads the first DCHAN and WCHAN values as absolute values whether or not a minus sign is present. In the second pass and subsequent reuses of annual values, if a minus sign is present and the annual values are to be reused (FLGUPD = 0, card 4), the model uses a computed value rather than the absolute parameter value.

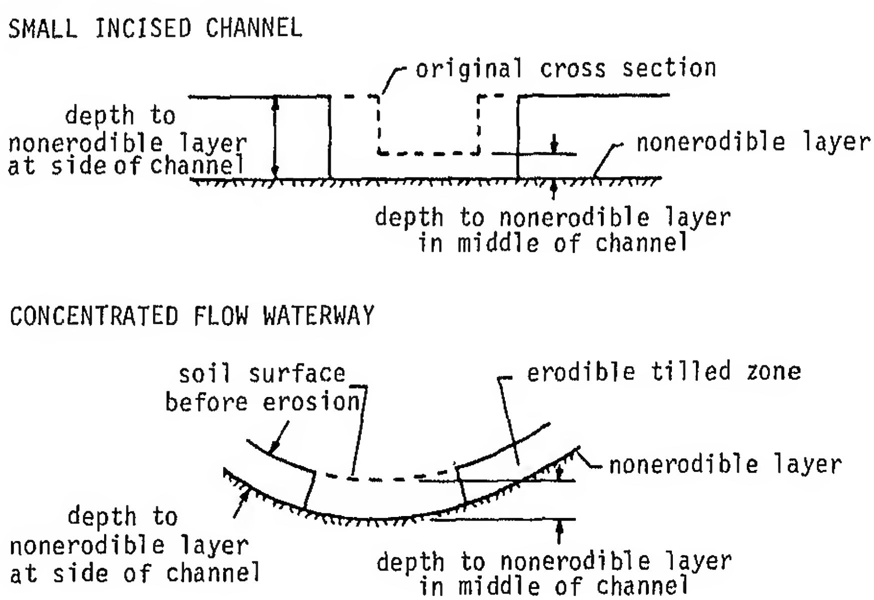


Figure 4-12.--Defining sketch for depths to nonerodible layer for a small incised channel and for a concentrated flow waterway.

Card No.	Parameter descriptions	Parameters								
1		NO-TILL CORN AND DRILLED BEANS-2 YR ROTATION, 20 YR RUN (56-75),OVL-CH								
2	Identification	OVERLAND FLOW HAS 2 SEGMENTS FOR K AND 2 SEGMENTS FOR NXF								
3		CHANNEL HAS 2 SEGMENTS FOR NXC, GRASS W/W FOR LOWER PART OF CHANNEL								
4		56	75	0	0	0	3	0		
5	Other initial general inputs									
6		0.15	0.65	0.20	0.01	490.0	4.0	0.05	1000.0	
8	Initial overland flow inputs	12.96	315.0	0.0476	0.006	0.07	0.03	150.0	11.2	285.0
9		2	0.66	0.32	1.0	0.49				
10		4	3	2	2					
11	Initial channel inputs	2.0	0.03	0.05						
12		770.0	12.96	0.563	1.0					
13		115.0	0.017	150.0	0.057	590.0	0.018	770.0	0.033	
16	Years in rotation	2								
17	Dates, year 1	001	121	211	274	300				
17	Dates, year 2	030	125	130	165	195	225	255	276	330
18	2 overland flow segments	2	0.66	1.0						
19		0.28	0.06	0.05	0.15	0.12				
20	Overland segment 1, year 1	0.9	0.9	0.9	0.9	0.9				
21		0.04	0.02	0.02	0.04	0.04				
19		0.12	0.05	0.05	0.15	0.12				
20	Overland segment 2, year 1	1.0	1.0	1.0	1.0	1.0				
21		0.045	0.03	0.03	0.045	0.05				
19		0.14	0.60	0.75	0.20	0.06	0.06	0.06	0.25	0.37
20	Overland segment 1, year 2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
21		0.04	0.03	0.012	0.012	0.012	0.012	0.015	0.030	0.025
19		0.14	0.60	0.75	0.20	0.06	0.06	0.06	0.25	0.37
20	Overland segment 2, year 2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21		0.05	0.035	0.02	0.02	0.02	0.02	0.02	0.035	0.035
22	2 channel segments	2	0.25	1.0						
23		0.075	0.050	0.05	0.075	0.075				
24		0.60	0.60	0.60	0.60	0.60				
25	Channel segment 1, year 1	0.75	0.75	0.75	0.75	0.75				
26		-0.75	-0.75	-0.75	-0.75	-0.75				
27		-5.0	-99.0	-99.0	-99.0	-99.0				
23		0.13	0.13	0.13	0.13	0.13				
24		0.90	0.90	0.90	0.90	0.90				
25	Channel segment 2, year 1	0.75	0.75	0.75	0.75	0.75				
26		-0.75	-0.75	-0.75	-0.75	-0.75				
27		-20.00	-99.0	-99.0	-99.0	-99.0				
23		0.06	0.04	0.033	0.033	0.033	0.033	0.033	0.075	0.045
24		0.60	0.15	0.10	0.20	0.30	0.40	0.50	0.60	0.60
25	Channel segment 1, year 2	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
26		-0.75	0.75	0.75	0.75	-0.75	-0.75	-0.75	-0.75	-0.75
27		-5.0	-99.0	5.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0
23		0.13	0.13	0.13	0.13	0.13	0.13	0.133	0.13	0.13
24		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
25	Channel segment 2, year 2	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
26		-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	-0.75
27		-20.00	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0

Figure 4-13.--Example erosion file for a field with a 2-year rotation of corn and soybeans, two overland flow segments, and two channel segments.

4.11 Example of Complex Erosion File

Figure 4-13 presents an erosion file for a field with two overland flow segments and two channel segments. The simulation is for 20 years of a 2-year rotation of no-till corn and drilled soybeans.

The erosion sequence is overland-channel, which is coded as a 3 on card 4. The overland flow profile has two soil erodibility factors (KSOIL). Card 9 shows KSOIL of 0.32 for the upper 0.66 relative distance of the overland profile and KSOIL of 0.49 for the rest of the profile.

The field channel has four slope segments, so NSC is entered as a 4 on card 10. The length and slope of each segment are entered on card 13.

Because the two segments of the overland flow profile are cropped differently, each requires a set of updatable parameters. Card 18 informs the model that two sets of parameters (cards 19 to 21) are to be used. Actually, <u>four</u> sets of cards 19 to 21 are used--one set for each overland flow segment in each of the 2 years of the corn-soybeans rotation.

Updatable parameters for the channel are varied to distinguish between bare soil on the upper 0.25 relative distance and a grass waterway on the remainder of the channel (card 22). A set of cards 23 to 27 is used for each channel segment in each year of the rotation.

CHAPTER 5

CHEMICALS COMPONENT

The chemicals component contains models that predict the loss of nutrients and pesticides from the watershed on a storm-by-storm basis. The two subcomponents--nutrients and pesticides--run independently. Coding of the input data tells the program which subcomponent to run. Each subcomponent needs two input files to run. Both subcomponents need the pass file created by the erosion/sediment component (see section 5.2). The nutrient subcomponent needs a file of nutrient parameters, and the pesticide subcomponent needs a file of pesticide parameters. Each subcomponent produces a printed output file and can create a pass file. These pass files are excellent bases for data analyses by statistical and other programs.

5.1 Preparation of Input Files

The nutrient subcomponent simulates nitrogen and phosphorus processes in the field. The phosphorus processes are field applications of this nutrient and losses of it in sediment and runoff. The nitrogen processes are plant uptake, mineralization, denitrification, nitrogen in runoff, nitrogen in sediment, leaching, fertilizer application, and content in rainfall. The nutrient subcomponent has two options for plant uptake of nitrogen. Use option 2.

The pesticide subcomponent considers multiple pesticide applications, including any combination of soil-incorporated, surface-applied, or foliar-applied pesticides. The subcomponent predicts the movement of pesticides on a storm-by-storm basis. It uses decay rates to degrade pesticides between storms. Values for residual pesticide content in the soil can be input initially to account for applications made before the period of simulation.

The model deals with the surface active layer of soil, which is assumed to be the top 1 cm (0.4 inch). It is from this layer that the pesticides are extracted into runoff, adsorbed by soil particles, or leached into the root zone.

Both subcomponents use metric units of measure in the input parameter files and output files. Table 5-1 presents conversion factors so that field data collected in English units can be converted to metric equivalents, and output can be converted to English units. No English-to-metric conversion is needed for parameters that are ratios of identical units, such as soil porosity (SOLPOR, nutrient card 5), which is a ratio of inches of water content to inches of soil.

Table 5-1.--Conversion factors for English and metric units

Unit to be converted	Multiplication factor	Equivalent unit
English to metric:		
Pound	0.454	Kilogram
Acre	0.405	Hectare
Inch	25.40	Millimeter
Inch	2.54	Centimeter
Pound/acre	1.12	Kilogram/hectare
Pint/acre	1.1678	Kilogram/hectare 1/
Quart/acre	2.3356	Kilogram/hectare 1/
Metric to English:		
Kilogram	2.205	Pound
Hectare	2.471	Acre
Millimeter	0.0394	Inch
Centimeter	0.3937	Inch
Kilogram/hectare	0.8929	Pound/acre
Kilogram/hectare	0.8563	Pint/acre 1/
Kilogram/hectare	0.4282	Quart/acre 1/

1/ The conversion factor assumes that the density of a liquid formulation of a chemical is equal to the density of water.

5.2 Erosion/ Sediment Pass File

This pass file is used as input for both subcomponents of the chemicals component. The information is repeated for each rainfall event. Figure 5-1 illustrates the structure of the pass file.

<u>Line Format</u> SDATE, RNFALL, RUNOFF, SOLOSS, ENRICH, DP, PERCOL, AVGTMP, AVGSWC, ACCPEV, POTPEV, ACCSEV, POTSEV

SDATE	Julian date of storm, e.g. 73139
RNFALL	Volume of rainfall (in), e.g. 4.27
RUNOFF	Volume of runoff (in), e.g. 1.58
SOLOSS	Amount of sediment loss (ton/acre) from field, e.g. 4.34
ENRICH	Sediment enrichment ratio, e.g. 1.31
DP	Number of days since the last storm when percolation occurred, e.g. 1
PERCOL	Percolation (in) below the root zone, e.g. 1.015
AVGTMP	Average temperature (degrees F.) between storms, e.g. 72.8
AVGSWC	Average soil water (in/in) between storms, e.g. 0.3239
ACCPEV	Actual evaporation from plants (EP, inches) for the period between storms, e.g. 0.022
POTPEV	Potential EP (in) for the period between storms, e.g. 0.022
ACCSEV	Actual evaporation from soil (ES, inches) for the period between storms, e.g. 0.000
POTSEV	Potential ES (in) for the period between storms, e.g. 0.000

Format(I6,F6.2,F6.2,F6.2,F6.2,I2,F6.2,F6.2,F6.3,F6.3,F6.3,F6.3,F6.3)

73139	0.48	0.00	0.00	0.00	0	0.00	70.730.3171	0.002	0.002	0.000	0.000
73143	0.52	0.00	0.00	0.00	0	0.00	71.530.3138	0.010	0.010	0.000	0.000
73144	0.23	0.00	0.00	0.00	0	0.00	72.180.3191	0.004	0.004	0.000	0.000
73148	4.27	1.58	4.34	1.31	1	1.01	72.810.3239	0.022	0.022	0.000	0.000
73156	0.28	0.00	0.00	0.00	0	0.00	74.230.3509	0.065	0.065	0.000	0.000
73157	1.22	0.12	0.11	2.63	1	0.38	75.220.3664	0.008	0.008	0.000	0.000
73159	0.60	0.01	0.01	4.15	1	0.13	75.530.3625	0.017	0.017	0.000	0.000
73160	0.50	0.03	0.02	2.77	1	0.20	75.830.3664	0.009	0.009	0.000	0.000
73161	0.25	0.00	0.00	0.00	0	0.00	76.030.3654	0.009	0.009	0.000	0.000
73164	0.78	0.03	0.03	2.91	1	0.19	76.400.3597	0.026	0.026	0.000	0.000

Figure 5-1.--Sample of a typical erosion/sediment pass file.

5.3 Nutrient Parameters

Figure 5-2 illustrates the structure of the nutrient file. For selected nutrient parameters, table 5-2 indicates sources and quality of estimates.

```
CARD
 NO                         NUTRIENT PARAMETER DATA
________________________________________________________________________________

 1                      NUTRIENT PARAMETERS - GEORGIA PIEDMONT
 2                             MANAGEMENT PRACTICE ONE
 3                      CONTINUOUS CORN - CONVENTIONAL TILLAGE
 4     73138       1       0       0       1
 5     0.410   0.320   0.650
 6         2
 7     0.200   0.200  20.000 0.00050 0.00018 0.05760 0.07000 16.8000 -0.160 11.2000
 8    -0.146   0.800
 9     73138   73305
10         2     141     305
11  450.0005700.000   2.500  47.000  73.000  30.000 250.000
12     73131
13    28.000  28.000   0.100
12     73174
13   112.000   0.000   1.000
 9     73306   74305
10         2     129     305
11  450.0005700.000   2.500  47.000  73.000  30.000 250.000
12     74119
13    28.000  28.000   0.100
12     74162
13   112.000   0.000   1.000
 9     74306   75305
10         2     151     305
11  450.0005700.000   2.500  47.000  73.000  30.000 250.000
12     75141
13    28.000  28.000   0.100
12     75176
13   112.000   0.000   1.000
 9     75306   75365
10         0     151     305
11  450.0005700.000   2.500  47.000  73.000  30.000 250.000
 9                 0
________________________________________________________________________________
```

Figure 5-2.--Sample data file for nutrient subcomponent.

Table 5-2.--Nutrient subcomponent: Definitions, sources, and quality of estimates for selected parameters

Parameter	Definition	Source of estimate 1/	Quality of estimate
SOLPOR	Porosity	Soil survey data (±30%); lab analysis (±15%); table A-3	Excellent for point samples; fair to poor for representations of variability in space
FC	Field capacity	Soil survey data (±30%); lab analysis (±15%); table A-3	Do
SOILN	Soil nitrogen	Soil test data (±40%); lab analysis (±20%); literature (±100%)	Good for sample soil series
SOILP	Soil phosphorus	Soil test data (±40%); lab analysis (±20%); literature (±100%)	Dependent upon sampling scheme for unsurveyed soils
EXKN	Extraction coefficient for nitrogen	Analysis of runoff data (±100%); literature (±300%)	Do
EXKP	Extraction coefficient for phosphorus	Analysis of runoff data (±100%); literature (±300%)	Do
AN	Enrichment coeffi- for nitrogen	Analysis of runoff data (±30%); literature (±300%)	Do
BN	Enrichment exponent for nitrogen	Analysis of erosion data (±30%); literature (±300%)	Do
AP	Enrichment coefficient for phosphorus	Analysis of erosion data (±30%); literature (±300%)	Do
BP	Enrichment exponent for phosphorus	Analysis of erosion data (±30%); literature (±300%)	Do

Table 5-2, continued.

Parameter	Definition	Source of estimate 1/	Quality of estimate
RCN	Concentration of nitrogen in rainfall	Lab analysis (±10%); literature (±100%)	Excellent for point samples; fair to poor for representation of variability in space
RZMAX	Maximum depth of root zone	Field study (±20%); soil survey (±100%)	Good for cultivated crops; poor for weeds, rangelands
YP	Yield potential	Local information (±15%); general information (±30%); table C-1	Occasionally available locally
POTM	Potential mineralization for nitrogen	Lab analysis (±20%); literature (±100%); table C-2	Excellent for point samples; fair to poor for representation of variability in space
DOM	Date of miduptake	Local information (±15%); general information (±30%); table C-3	Generally not available on a local basis
SD	Standard deviation of uptake	Local information (±15%); general information (±30%)	Do
PU	Potential nitrogen uptake	Local information (±15%); general information (±30%) table C-3	Do

1/ Percentages indicate ranges and accuracies for sources of estimates (CRR 26, p. 309).

5.4 Cards 1 to 8: Initial Nutrient Parameters

Cards 1 to 3 TITLE()

TITLE Three lines, 80 characters each, for the alphanumeric information you want printed at the beginning of the output.

Card 4 BDATE, FLGOUT, FLGIN, FLGPST, FLGNUT, FLGPAS

BDATE — The beginning Julian date for simulation, e.g. 73138; BDATE must be less than the first SDATE from the erosion/sediment pass file or date of first storm.

FLGOUT
- 0 For annual summary output;
- 1 For annual and monthly summary output;
- 2 For individual storm and all summary output. Caution: FLGOUT = 2 generates a large volume of output.

FLGIN
- 0 If the erosion/sediment pass file input is in English units and the program will convert them to metric units;
- 1 If the pass file values are already in metric units.

The CREAMS model generates the erosion/sediment pass file in English units; therefore, use FLGIN = 0

FLGPST
- 0 If the program is not to simulate pesticides;
- 1 If the program is to simulate pesticides.

Pesticides and nutrients cannot be simulated concurrently; therefore, FLGPST = 0 if nutrients are to be simulated.

FLGNUT
- 0 If the program is not to simulate nutrients;
- 1 If the program is to simulate nutrients.

FLGPAS
- 0 If a pass file is not desired;
- 1 If a nutrient pass file is to be created for days with runoff, (example figure 5-3, page 5-11). The file will show nitrogen and phosphorus load (kg/ha) and concentration (ppm) in runoff, and nitrogen and phosphorus load (kg/ha) in sediment.
- 2 If a nutrient pass file is to be created for days with rainfall (figure 5-4, page 5-11). The file will show nitrogen and phosphorus load (kg/ha) in runoff and sediment, mineralization, plant uptake, leaching, denitrification, soil nitrate, and nitrogen content of rain.
- 3 If both nutrient pass files are to be created.

Card 5 — SOLPOR, FC, OM

SOLPOR — Soil porosity (in/in), e.g. 0.40; see table A-3, page A-4. The SOLPOR value should be the same as that used for POROS on card 5 in the hydrology component.

FC — Field capacity (in/in), e.g. 0.32; see table A-3, page A-4. This FC value should be the same as that used to compute FUL on card 5 in the hydrology component.

OM — Organic matter (percentage of soil mass) susceptible to denitrification in the effective root zone, e.g. 0.65 for 0.65 percent; obtain from SOILS-5 sheet.

Usually, the OM value is about one-half of the value used for SOLORG on card 6 in the erosion/sediment component.

Card 6 — OPT

OPT
1 For option 1 nitrogen uptake;
2 For option 2 nitrogen uptake. Option 2 is the preferred method. (CRR 26, p. 295)

Card 7 — SOLN, SOLP, NO3, SOILN, SOILP, EXKN, EXKP, AN, BN, AP

SOLN — Soluble nitrogen (kg/ha) in surface 1 cm, e.g. 0.2; use 0.2 unless test data are available. (CRR 26, p. 74, 296)

SOLP — Soluble phosphorus (kg/ha) in surface 1 cm, e.g. 0.2; use 0.2 unless test data are available. (CRR 26, p. 296)

NO3 — Nitrate (kg/ha) in root zone, e.g. 20.0; value is dynamic, but use 20.0 as a starting point unless local data are available. (CRR 26, p. 296)

SOILN — Total soil nitrogen (kg/kg) in surface 1 cm, e.g. 0.0005; typical values range from 0.0005 to 0.003. (CRR 26, p. 296)

SOILP — Total soil phosphorus (kg/kg) in surface 1 cm, e.g. 0.00018; typical values range from 0.0001 to 0.0013. (CRR 26, p. 296)

EXKN — Extraction coefficient for nitrogen, e.g. 0.0576; typical values range from 0.05 to 0.10. (CRR 26, p. 296, 358)

EXKP — Extraction coefficient for phosphorus, e.g. 0.07; typical values range from 0.05 to 0.10. (CRR 26, p. 296, 358)

AN — Enrichment coefficient for nitrogen, e.g. 16.8; use of 7.4 is recommended if data are not available. (CRR 26, p. 296)

BN — Enrichment exponent for nitrogen, e.g. -0.16; use of -0.2 is recommended if data are not available. (CRR 26, p. 296)

AP — Enrichment coefficient for phosphorus, e.g. 11.2; use of 7.4 is recommended if data are not available. (CRR 26, p. 296)

<u>Card 8</u> — BP, RCN

BP — Enrichment exponent for phosphorus, e.g. -0.146; use of -0.2 is recommended if data are not available. (CRR 26, p. 296)

RCN — Concentration of nitrogen in rainfall (mg/l or ppm), e.g. 1.0 (CRR 26, p. 72, 296)

5.5 Cards 9 to 13: Updatable Nutrient Parameters — The rest of the inputs to the nutrient subcomponent are updatable. The program checks the storm dates (SDATE, erosion/sediment pass file) against the parameters control date (CDATE, card 9). If the control date is less than the date of the storm, the program reads in a new set of updatable parameters. If the program reads a blank or zero in place of the control date (CDATE, card 9), the program stops executing.

<u>Card 9</u> — PDATE, CDATE

PDATE — First date (Julian) on which the updatable nutrient parameters (card 10) are valid, e.g. 73138

The program does not read the PDATE value, which is simply an aid for the user in putting together the data file.

CDATE — Last date (Julian) on which the updatable nutrient parameters (card 10) are valid, e.g. 73305

A card 9 must precede each set of updatable parameters. Planting, harvesting, and incorporating organic matter are among the field operations that should change CDATE. A blank or zero for CDATE stops program execution.

<u>Card 10</u> — NF, DEMERG, DHRVST

NF — Number of fertilizer applications, e.g. 2

DEMERG — Day (Julian) of plant emergence, <u>not</u> planting date, e.g. 141

DHRVST — Day (Julian) of plant harvesting, e.g. 305

Note — When no new plant nutrient values are to be read, leave card 10 blank; the program will then skip reading the remaining nutrient parameters.

Card 11 — RZMAX, YP, DMY, POTM, DOM, SD, PU

Card 11 has two options, but data for option 1 are difficult to obtain (see CRR 26, p. 298). Option 2 is recommended and is the option described here.

RZMAX — Effective depth (mm) of the root zone, e.g. 450.0; use RD value (hydrology card 6, hydrology option 1), but first convert RD to millimeter units. (CRR 26, p. 78)

YP — Potential yield (kg/ha) of harvestable product, e.g. 5700.0; see table C-1, page C-2 or SOILS-5 sheet. (CRR 26, p. 73)

DMY — Dry matter yield ratio. Use 2.5 for corn, 3.7 for wheat and small grain, 4.2 for soybeans, and 6.5 for cotton. (CRR 26, p. 297)

POTM — Potential mineralizable nitrogen (kg/ha) in root zone, e.g. 47.0; see table C-2, page C-3, and SOILS-5 sheet. (CRR 26, p. 90, 297)

DOM — Midpoint (number of days) of nitrogen uptake cycle, e.g. 73.0; see table C-3, page C-3. (CRR 26, p. 503)

SD — Standard deviation of DOM (days), e.g. 30.0; see table C-3. (CRR 26, p. 503)

PU — Potential nitrogen uptake (kg/ha), e.g. 250.0; see table C-3. (CRR 26, p. 503)

Card 12 — DF

DF — Date (Julian) of fertilizer application, e.g. 73131

Card 13 — FN, FP, FA

FN — Nitrogen applied (kg/ha), e.g. 28.0

FP — Phosphorus applied (kg/ha), e.g. 28.0

FA — Surface fraction of application, e.g. 0.1

Use the ratio of 1 cm to the depth (cm) of incorporation. If fertilizer is injected, use 0.0; if surface applied, use 1.0; if disked 10 cm (4 in) deep use 0.1.

Notes — Phosphorus (FP) and nitrogen (FN) inputs are for elemental forms of these nutrients. Elemental P = 0.436 x P_2O_5, as labeled on fertilizer bags. Example, 64 kg/ha of fertilizer phosphate = (0.436 x 64) = 27.9 kg/ha of phosphorus for model.

Cards 12 and 13 are repeated for each application of fertilizer (NF, card 10). A maximum of 20 applications can be read in one update.

5.6 Nutrient Pass Files

Figure 5-3 is an example of a nutrient pass file for FLGPAS = 1 (card 4). Figure 5-4 is an example for FLGPAS = 2. When FLGPAS = 3, the model generates both types of pass files.

TAYLOR CREEK-NUBBIN SLOUGH WATERSHED, IMMOKALEE FINE SAND CONTINUOUS CORN SILAGE-CORN SILAGE-RYE WINTER COVER WITH IRRIGATION PLANT NUTRIENT SIMULATION, 1972-73 TEST OF NUTRIENT PASS FILE, CODE=3

DATE	RAIN	RUNOFF	PERC	SDMNT	RUNOFF N		RUNOFF P		SDMNT N	SDMNT P
	CM	CM	CM	KG/HA	KG/HA	PPM	KG/HA	PPM	KG/HA	KG/HA
72091*	6.81	1.07	1.19	605.2	0.53	4.93	0.06	0.56	1.24	0.62
72161*	8.25	2.13	4.32	2443.3	0.69	3.21	0.13	0.61	3.80	1.90
72170	8.64	2.03	3.66	2331.3	0.61	3.01	0.09	0.47	3.66	1.83
72171	3.17	0.20	2.24	179.3	0.11	5.48	0.01	0.47	0.47	0.24
72240*	3.68	0.13	0.0	44.8	0.18	13.89	0.01	0.47	0.16	0.08
72241	4.44	0.58	0.23	336.2	0.26	4.49	0.03	0.47	0.78	0.39
72243	8.92	3.28	5.05	2981.3	0.45	1.36	0.15	0.47	4.45	2.23

Format(I6,A1,3F6.2,F8.1,2F7.2,F8.2,F7.2,2F9.2)

Figure 5-3.--Sample of nutrient pass file for FLGPAS = 1.

TAYLOR CREEK-NUBBIN SLOUGH WATERSHED, IMMOKALEE FINE SAND
CONTINUOUS CORN SILAGE-CORN SILAGE-RYE WINTER COVER WITH IRRIGATION
PLANT NUTRIENT SIMULATION, 1972-73 TEST OF NUTRIENT PASS FILE, CODE=3

DATE	RAIN	RUNOFF	PERC	SDMNT (L-1)	RUNOFF N		RUNOFF P		SDMNT N	SDMNT P
				(LINE 2)	MINRLZ	UPTAKE	LEACH	DENIT	SOILN	RAINN
	CM	CM	CM	--------------------------KG/HA--------------------						
72047	0.38	0.0	0.0	0.0	0.0		0.0		0.0	0.0
					0.47	0.0	0.0	0.0	94.31	0.04
72048	0.25	0.0	0.0	0.0	0.0		0.0		0.0	0.0
					0.48	0.0	0.0	0.0	90.73	0.03
72058	0.15	0.0	0.0	0.0	0.0		0.0		0.0	0.0
					4.55	0.0	0.0	0.0	92.75	0.02
72063	2.16	0.0	0.0	0.0	0.0		0.0		0.0	0.0
					2.51	0.0	0.0	0.0	173.38	0.22
72091*	6.81	1.07	1.19	605.2	0.53		0.06		1.24	0.62
					16.74	0.0	25.71	5.25	181.20	0.68

Format (I6,A1,3F6.2,F8.1,F12.2,F11.2,F12.2,F11.2,1X,/,38X,F6.2,F8.2,4F7.2)

Figure 5-4.--Sample of nutrient pass file for FLGPAS = 2.

Analysis of Pass Files	The pass files permit quicker and more flexible analysis of output. They can be scanned quickly for unusual events, because all the nutrient-loss information is on consecutive lines by storm date. Also, with available software, for example, Statistical Analytical System (SAS), the output can quickly be analyzed by computer.
Structure of Pass Files	Variables in the nutrient pass file are as listed below.
DATE	Julian date.
*	Flag to indicate first runoff after application of fertilizer.
RAIN	Rainfall, cm.
RUNOFF	Runoff, cm.
PERC	Percolation, cm.
SDMNT	Sediment, kg/ha.
RUNOFF N	Nitrate mass reported as the nitrogen element, N, kg/ha.
RUNOFF N	Nitrate concentration reported as the concentration of nitrogen, N, ppm.
RUNOFF P	Phosphorus mass reported as the phosphorus element, P, kg/ha.
RUNOFF P	Phosphorus concentration reported as the phosphorus element, P, ppm.
SDMNT N	N in sediment, kg/ha.
SDMNT P	P in sediment, hg/ha.
MINRLZ	Mineralized N, kg/ha.
UPTAKE	Plant uptake of nitrate, NO_3, as N, kg/ha.
LEACH	Leaching of nitrate, NO_3, as N, kg/ha.
DENIT	Denitrification of nitrogen, kg/ha.
SOILN	Soil N, kg/ha.
RAINN	Nitrate, NO_3, in rainfall as N, kg/ha.

Pesticide Parameters

Figure 5-5 illustrates the structure of the pesticide parameter file. For selected parameters, table 5-3 indicates sources and quality of estimates.

```
CARD
 NO
  1                        PESTICIDE PARAMETERS - GEORGIA PIEDMONT
  2                               MANAGEMENT PRACTICE ONE
  3                        CONTINUOUS CORN - CONVENTIONAL TILLAGE
  4    73138      0      0        1        0        0       1
  5    0.410  0.320  0.650
  6        2  74120  75365
  7        1  ATRAZINE          33.0      0.0     0.100      2.0     0.0     0.
  7        2  PARAQUAT      500000.0      0.0     0.007  10000.0     0.0     0.
  8     1121   1131      1
  9        1   3.36  1.000   1.000      0.0   1.000        0.0
  8     1132   2120      1
  9        2  2.049  1.000   1.000      0.0   1.000        0.0
  8               0
```

Figure 5-5.--Sample of pesticide parameter file.

ards 1 to 7:
nitial
esticide
arameters

ards 1 to 3 — TITLE()

TITLE — Three lines, 80 characters each, for the alphanumeric information you want printed at the beginning of the output.

ard 4 — BDATE, FLGOUT, FLGIN, FLGPST, FLGNUT, FLGPAS, IROT

BDATE — The beginning date (Julian) for simulation, e.g. 73138; BDATE must be less than the first SDATE from the erosion/sediment pass file.

FLGOUT
- 0 For annual summary output;
- 1 For annual and monthly summary output;
- 2 For individual storm and all summary output. Caution: FLGOUT = 2 generates a large amount of output.

FLGIN
- 0 If the storm hydrology input is in English units and the program will convert them to metric units;
- 1 If the values are already in metric units.

The CREAMS model generates the erosion/sediment pass file in English units; therefore, use FLGIN = 0.

Table 5-3.--Pesticide subcomponent: Definitions, sources, and quality of estimates for selected parameters

Parameter	Definition	Source of estimate	Quality of estimate 1/
SOLH20	Pesticide solubility in water	Handbooks, tables D-1, D-2, and D-11	Good to excellent for most pesticides
HAFLIF	Foliar pesticide half-life	Tables D-3 D-4, and D-11; literature, measurement	Fair to good for some pesticides
DECAY	Dissipation rate from soil surface (listed in tables as k_s)	Table D-5 to D-7 and D-11, literature, measurement	Fair to good, but site- and condition-specific; measurements from bulk soil often underestimate
KD	Distribution coefficient	CRR 26, literature, measurement, tables D-8 and D-11	Fair to good, but laboratory value may poorly describe field behavior
FOLRES	Initial foliar residue	Experience, measurement	Unknown quality always "depends on" the source
SOLRES	Initial soil residue	Measurement, inferred from past management and pesticide persistence	Good if measured; poor if inferred, depending upon pesticide
WSHFRC	Fraction of foliar pesticide washed off	Table D-9, literature	Good for a few pesticides; fair to unknown for others
APRATE	Pesticide application rate	Recommendations on label, farm records	Good, but depends on application equipment and operator care
DEPINC	Depth of pesticide incorporation	Application recommendation, experience	Good, but depends on soil conditions
EFFINC	Efficiency factor for incorporation	Measurement, experience	Fair to good
FOLFRC	Fraction on foliage	Table D-10, experience, observations	Do.
SOLFRC	Fraction on soil	CRR 26, experience, observations	Do.
WSHTHR	Rainfall threshold for washoff	Judgment based on canopy, table D-9	Probably fair, subjective

1/ Excellent - known to be within few percent; good - errors of 50% possible; fair - error by factor of 2 possible; poor - error by factor in excess of 2 possible.

FLGPST 0 If the program is not to simulate pesticides;
1 If the program is to simulate pesticides.

FLGNUT 0 If the program is not to simulate plant nutrients;
1 If the program is to simulate plant nutrients.

Pesticides and nutrients cannot be simulated concurrently; therefore, FLGNUT = 0, if pesticides are to be simulated.

FLGPAS 0 If a pass file is not desired;

1 If a pesticide mass pass file is to be created for days with runoff (example, figure 5-6, page 5-19);

2 If a pesticide concentration pass file is to be created for days with runoff (example, figure 5-7, page 5-20);

3 If both types of pesticide pass files are to be created.

IROT Number of years in a rotation cycle, as follows:

0 If pesticide application dates change each year and input is for each year of simulation;
1 If the same crop is grown each year and the same pesticide parameters are to be reused each year of the simulation;
2 to 20 For the number of years in the rotation--the pesticide parameters are reused each rotation cycle of the simulation.

Card 5 SOLPOR, FC, OM

SOLPOR Soil porosity (in/in), e.g. 0.41; estimate from table A-3, page A-4. The SOLPOR value should be the same as that used for POROS on card 5 in hydrology component.

FC Field capacity (in/in), e.g. 0.32; estimate from table A-3. This FC value should be the same as that used to compute FUL on card 5 in the hydrology component.

OM Organic matter (percentage of soil mass), e.g. 0.65 for 0.65 percent; obtain value from SOILS-5 sheet.

Card 6 NPEST, PBDATE, PEDATE

NPEST Number of different pesticides from 1 to 10, e.g. 2; if NPEST = 0 or is left blank, the pesticide model will not run.

PBDATE Date (Julian) on which the model begins to consider pesticides, e.g. 74120; table A-1.

PEDATE Date (Julian) on which the model stops considering pesticides, e.g. 75365

Card 7 — NOPEST, PSTNAM, SOLH20, HAFLIF, DECAY, KD, FOLRES, SOLRES, WSHFRC

NOPEST — Pesticide identification number from 1 to 10, e.g. 1

PSTNAM — Pesticide name, as many as 16 characters, e.g. atrazine; format is 4A4.

SOLH20 — Water solubility (ppm), e.g. 33.0; see tables D-1, D-2, and D-11, pages D-2, D-3, and D-24. (CRR 26, p. 311-312)

HAFLIF — Foliar residue half-life (days), e.g. 0.0; see tables D-3, D-4, and D-11, pages D-4 to D-6, and D-24. (CRR 26, p. 599-602)

DECAY — Decay constant, e.g. 0.10; use k_s value in tables D-5 to D-7 and D-11, pages D-7 to D-12, and D-24. (CRR 26, p. 323, 563-574)

The equation for k_s is--

$$k_s = \frac{0.693}{T_{1/2}}$$

where $T_{1/2}$ = soil half-life of pesticide (days).

KD — Ratio of the concentration of pesticides in soil to the concentration of pesticides in water, e.g. 2.0; see k_d value in tables D-8 and D-11, pages D-20 and D-24. (CRR 26, p. 324, 611-613).

FOLRES — Amount of pesticide residue on the foliage (µg/g or ppm) when simulation begins, e.g. 0.0; use 0.0 for annual simulations. (CRR 26, p. 322)

SOLRES — Amount of pesticide on the soil (µg/g or ppm) when simulation begins, e.g. 0.0 (CRR 26, p. 322)

WSHFRC — Fraction on the foliage available for rainfall washoff, e.g. 0.0; see table D-9, page D-22. For organochlorines, WSHFRC usually is 0.05 to 0.1. For other classes of pesticides, it usually is 0.6 to 0.7. (CRR 26, p. 323)

Note — A card 7 is read for each pesticide (NPEST, card 6). All card 7's are read together; for example, if two pesticides are to be run, the card 7 for pesticide 1 (NOPEST) is followed by a card 7 for pesticide 2 (NOPEST), and so on. Refer to figure 5-5 (page 5-13) for example.

.9 Cards 8 and 9: Updatable Pesticide Parameters

The rest of the input data for the pesticide subcomponent are updatable. The program checks the dates (SDATE, erosion/sediment pass file) against the parameters contro date (CDATE, card 8). If CDATE is less than SDATE, the program reads in a new set of the updatable parameters.

A set of cards 8 and 9 is used for each update period of rotation cycle or simulation run, depending on the value IROT on card 4. With each card 8, use as many card 9's a indicated by the value of IPST on card 8. For example, i IPST = 4, four card 9's are used--one for each pesticide applied on the given PDATE.

<u>Card 8</u> PDATE, CDATE, IPST

PDATE First date on which the pesticide parameter values on car 9 are valid. PDATE is the date of application of the pesticide identified by NOPEST on card 9, e.g. 1121; the first digit in PDATE is the numerical sequence of the yea in the rotation cycle and the last three digits are the Julian day.

CDATE Last date on which the pesticide parameters on card(s) 9 are valid, for example, the day before the next pesticide application. As in PDATE, the first digit in CDATE is th numerical sequence of the year in the rotation cycle and the last 3 digits are the Julian day (e.g. 1131).

If the program reads a blank for CDATE, the program stops executing.

IPST The number of pesticides applied on PDATE, e.g. 1

<u>Card 9</u> NOPEST, APRATE, DEPINC, EFFINC, FOLFRC, SOLFRC, WSHTHR

NOPEST Pesticide identification number, e.g. 1

APRATE Rate of application (kg/ha) of active ingredient, e.g. 3. (CRR 26, p. 321)

DEPINC Depth of incorporation (cm). Use 1.0 for surface applied and use 8.0 to 15.0 for double disking, rotary tillers, a other major tillage equipment. (CRR 26, p. 321)

EFFINC Efficiency of incorporation. Use 1.0 for pesticide unifo mixed in soil, 2.0 for pesticide applied on soil surface for pesticide unevenly incorporated by tillage that leave twice as much pesticide in the upper 1 cm of soil as in t rest of the soil, and a value ranging from 0.5 to 1.0 for injected or banded pesticide. (CRR 26, p. 321)

FOLFRC — Fraction of pesticide applied to the foliage, e.g. 0.0; see table D-10, page D-23. (CRR 26, p. 321)

SOLFRC — Fraction applied to the soil, e.g. 1.0 (CRR 26, p. 321)

WSHTHR — Rainfall threshold (cm) for foliage washoff, e.g. 0.0; see table D-2, page D-3. Range for WSHTHR generally is 0.1 to 0.3 cm. (CRR 26, p. 322)

Notes on FOLFRC and SOLFRC — The amount of pesticide that reaches a target field (foliage and soil) is approximately 75 (± 20) percent of the applied rate by ground methods and 50 (± 20) percent by aerial methods of application. The loss during application is due to volatilization and aerial drift. Assign fractions for foliage and soil according to the plant canopy. For an example of two pesticides applied on the same day, see figure 6-9, page 6-12.

5.10 Pesticide Pass Files

The pass files generated by the pesticide model contain most of the data in a daily-option printout. You can obtain pesticide files in units of mass, concentration, or both (see description of FLGPAS, card 4).

Figure 5-6 is a sample pesticide pass file for FLGPAS = 1 (pesticide mass). Figure 5-7 is a pass file sample for FLGPAS = 2 (pesticide concentration). Both files are printed if FLGPAS = 3.

The first three lines of each pass file contain the identification in the TITLE input cards. The next two lines include the number of years of simulation and the number of pesticides simulated. The next four lines are column headings that identify the variable or pesticide and the units of measure.

The rest of each file is groups of columnar data for each rainfall day. There are three lines per day. Line 1 contains storm information and pesticides in runoff; line 2 contains pesticides in sediment. If only one pesticide is tabulated in a column, line 3 is blank and is the last line of a group. If two pesticides are tabulated in one column, lines 3 and 4 give--for the second pesticide--the same kinds of information as that given in lines 1 and 2 for the first pesticide.

Variables in the pesticide pass file are as follows:

Variable	Definition	Line
DATE	Date of storm	1
RAIN	Amount of rainfall	1
RUNOFF	Amount of runoff	1
SDMNT	Volume of sediment	1
Pesticide name	Pesticide in runoff	1
Pesticide name	Pesticides in sediment	2
*	Flag to indicate first runoff after application of pesticide	

In figures 5-6 and 5-7, the pesticides are atrazine, paraquat, and carbaryl.

```
TAYLOR CREEK-NUBBIN SLOUGH WATERSHED, IMMOKALEE FINE SAND
CONTINUOUS CORN SILAGE-CORN SILAGE-RYE WINTER COVER WITH IRRIGATION
PESTICIDE SIMULATION, 1972-73 ADEL, MIKE, RICHARD, BOB  PASSFILE CODE=3

NO. YRS. SIMULATION     NO. PESTICIDES
              2               3

       LINE 1 = WATER FRACTION; LINE 2 = SEDIMENT FRACTION
   DATE  RAIN  RUNOFF   SDMNT     ATRAZ     PARAQ     CARBA
                                 --------  --------  --------

           CM      CM   KG/HA      G/HA      G/HA      G/HA

  72091  6.81    1.07  605.23  2.23996*  0.00130*  0.0
                               0.04361   2.11485   0.0

  72161  8.25    2.13 2443.34 11.59212*  0.00482*  0.00000*
                               0.16726   5.79170   0.00000

  72170  8.64    2.03 2331.26  0.59244   0.00423   0.0
                               0.00962   5.73050   0.0

  72171  3.17    0.20  179.33  0.01796   0.00041   0.0
                               0.00058   1.11054   0.0

  72240  3.68    0.13   44.83  0.00001   0.00016   0.00000*
                               0.00000   0.24393   0.00000

  72241  4.44    0.58  336.24  0.00001   0.00072   0.0
                               0.00000   0.85303   0.0
```

Format: (1,I6,1X,F6.2,2F8.2,5(F9.5,A1),/,29X,5(F9.5,1X))

Figure 5-6.--Sample of pesticide pass file for FLGPAS = 1.

TAYLOR CREEK-NUBBIN SLOUGH WATERSHED, IMMOKALEE FINE SAND
CONTINUOUS CORN SILAGE-CORN SILAGE-RYE WINTER COVER WITH IRRIGATION
PESTICIDE SIMULATION, 1972-73 ADEL, MIKE, RICHARD, BOB PASSFILE CODE=3

NO. YRS. SIMULATION	NO. PESTICIDES
2	3

LINE 1 = WATER FRACTION; LINE 2 = SEDIMENT FRACTION

DATE	RAIN	RUNOFF	SDMNT	ATRAZ	PARAQ	CARBA
	CM	CM	KG/HA	PPM	PPM	PPM
72091	6.81	1.07	605.23	0.02100*	0.00001*	0.0
				0.07206	3.49429	0.0
72161	8.25	2.13	2443.34	0.05433*	0.00002*	0.00000*
				0.06846	2.37040	0.00000
72170	8.64	2.03	2331.26	0.00292	0.00002	0.0
				0.00413	2.45811	0.0
72171	3.17	0.20	179.33	0.00088	0.00002	0.0
				0.00324	6.19280	0.0
72240	3.68	0.13	44.83	0.00000	0.00001	0.00000*
				0.00000	5.44088	0.00000
72241	4.44	0.58	336.24	0.00000	0.00001	0.0
				0.00000	2.53698	0.0
72242	5.84	1.35	896.64	0.00000	0.00001	0.0
				0.00000	1.48008	0.0
72243	8.92	3.28	2981.33	0.0	0.00001	0.0
				0.0	2.30307	0.0
72244	2.90	0.15	67.25	0.0	0.00001	0.0
				0.0	4.09993	0.0
73040	3.68	0.20	493.15	0.00021*	0.00001*	0.0
				0.00037	1.69191	0.0
73068	2.67	0.05	112.08	0.14475*	0.00002*	0.0
				0.54193	7.69477	0.0

Format (1,I6,1X,F6.2,2F8.2,5(F9.5,A1),/,29X,5(F9.5,A1))

Figure 5-7.--Sample of pesticide pass file for FLGPAS = 2.

CHAPTER 6

EXAMPLE APPLICATION

This chapter describes an example of the use of CREAMS for determining the effects of management on water, sediment, and agricultural chemicals. This is the purpose for which the model was designed, but CREAMS simulates many physical processes. Therefore, users may apply it for other purposes.

To show how you can use the model to evaluate alternative systems, this chapter describes some field situations and explains how data files are developed and manipulated. See chapter 1 (section 1.4) to review the general approach for using the model.

6.1 Data Files for Base Management System on Cropland

The representative field is located just outside Tifton, Georgia, in the Southern Coastal Plain major land resource area. The topography of the 72-acre field is shown in figure 6-1. The crop is continuous corn, and the field is farmed approximately parallel to the long axis of the field. The soil is Tifton loamy sands, 2 to 5 percent slopes. Cultural practices and chemical applications are shown on the completed field data worksheets (figure 6-2).

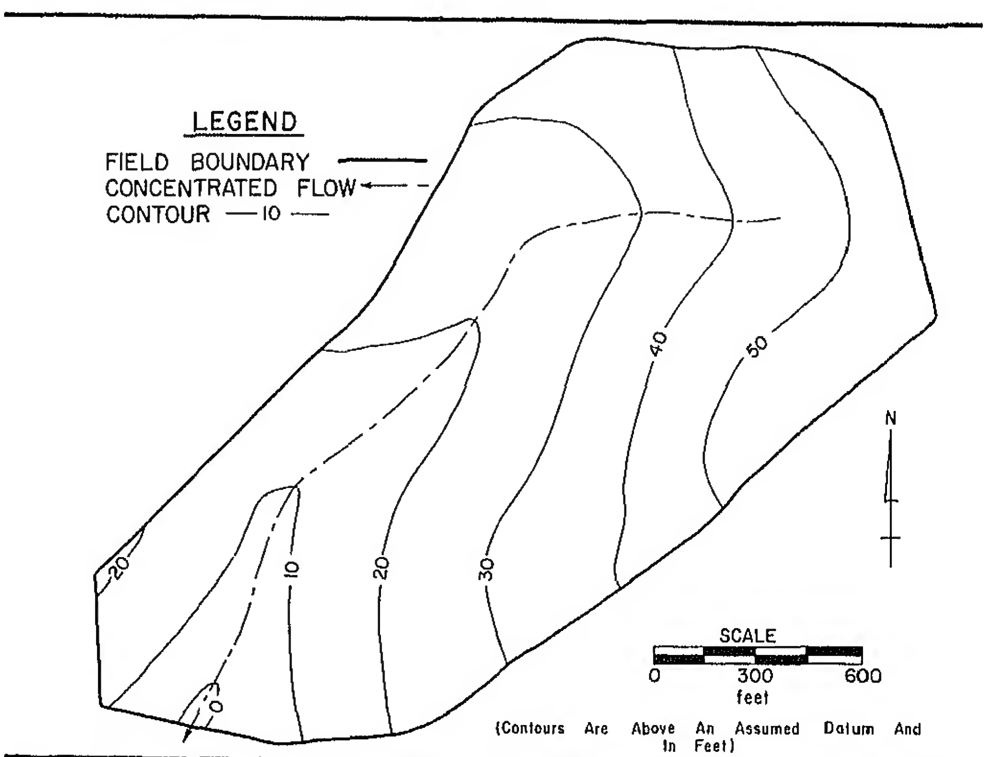


Figure 6-1.--Watershed selected from field.

Field Data Worksheet for the CREAMS Model

I. Climatological Data

A. Location of field

State Georgia   County Tifton

B. Nearest local climate station

State Georgia   City Tifton

C. Location and name of nearest State experiment station, if any:

Tifton – Coastal Plain Experiment Station

II. Topographic and Soils Data

A. A topographic map of the field is needed. Is a field grid survey or topographic map available? Yes (YES or NO) If yes, please provide a copy. Field Grid furnished

Is a USGS topographic map available? No (YES or NO) If yes, provide a copy or give name of topographic map.

B. Aerial Photo

A copy of the aerial photo with the field and soils delineated is needed. Also, designate row direction. Provided

C. Is there a county soil survey available? (YES or NO) If yes, please provide a copy with the field drawn on the appropriate soil map.

1983 Soil Survey provided with field outline in red

If no, please delineate and label the soils on the aerial photo. Estimate of soil boundaries is adequate.

III. Crops and Cultural Practices

A. Single crop ✓   Crop rotation ____

Double crop ____   Native range ____   Pasture ____

B.

Crops	Plant date or grazing start date(s)	Harvest date(s) or grazing end date(s)	Maximum active root zone (inches)
Corn	March 15	Oct. 1	36

Figure 6-2.--Example of field data worksheet for CREAMS (page 1 of 3).

IV. Farming Operation in Field

Date	Type of operation	Tillage depth
Feb. 15	Disk	4"
Mar. 10	Disk & harrow	4"
Mar. 15	Plant	2'
Apr. 15	Cultivate	2"
May 1	Cultivate	2"
May 15	Cultivate	2"
Oct 10	Moldboard plow	5"
Nov. 15	Disk	4"

V. Chemical Operations

A. Fertilizer

Date of application	Quantity by formula		Method of application (injected, surface, etc.)
Mar. 10	270 lb./acre	5-10-10	incorporated 4"
May 1	270 lb./acre	33-0-0	Surface-topdress

If the farmer has a recent soils analysis, please provide copy.

B. Pesticides

Date of application	Type of pesticide	Trade or generic name	Rate of application of active ingredient (units)	Method of application
Mar. 10	Herbicide	Atrazine	2.5 lbs./ac.	incorp.
Mar 10	"	Carbofuran	2.0 lbs./ac.	"
May 15	Insecticide	Sevin	0.4 lbs/ac.	spray
June 1	"	"	"	"

VI. Conservation Practices Applied

None

Figure 6-2.--Example of field data worksheet for CREAMS (page 2 of 3).

VII. What are the recommended resource management systems for this field? (list only 2 systems)

A. Winter cover crop

B. Graded terraces with waterway

VIII. What has been the cropping history of this field? (Brief narrative is satisfactory, unless there has been a radical change in land use or chemicals applied in the last 5 years.)

Continuous corn

IX. Outlet Ditch Receiving Runoff Water from Field

A. Shape (circle one): Triangular Rectangular Naturally eroded

B. Dimensions:

Slope of ditch banks (horizontal/vertical) 2.0 ft/ft

Grade of ditch (vertical/horizontal) 0.015 ft/ft

Length 800 ft Top width 40 ft

Depth 4 ft Bottom width (if rectangular) ____ ft

C. Vegetative cover conditions (circle one):

Excellent Good Fair Poor

Very poor, primarily bare soil Bare soil

D. Soil texture Loamy sands

E. Is there a culvert or bridge that constricts runoff? (YES or NO) If yes, attach a sketch showing the dimensions.

X. Terraces (Present or Recommended)

A. Slope of terrace channel (vertical/horizontal) 0.014 ft/ft

B. For underground outlet terraces, height of fill is ____ ft and inside diameter of orifice in riser is ____ inches.

Brian Burt	1-4-84	(817) 592-0000
District Conservationist	Date	Phone Number

Figure 6-2.--Example of field data worksheet for CREAMS (page 3 of 3).

Hydrology Component

With the cropping information known, we can set up the hydrology run. A rainfall data file is developed from raingage information at the Coastal Plain Experiment Station in Tifton. A 10-year period of daily rainfall (1965-1974) is used.

We now consider a file-naming scheme. The rainfall file is used for all the alternatives and is named (CREAMS/RAIN.TIFT) (figure 6-3). The second file needed for the hydrology component is a parameter file, which we name (CREAMS/HYDPAR.TIFT) (figure 6-4). Outputs from this hydrology run are a printed file and a punched pass file, which we name (CREAMS/HYDPAS.TIFT).

(CREAMS/RAIN.TIFT)

CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.26	1
CPES65	0.0	0.0	0.0	0.0	0.12	0.16	0.0	0.0	0.0	0.0	2
CPES65	0.0	0.0	0.0	2.31	0.0	0.03	0.0	0.0	0.0	0.03	3
CPES65	0.12	0.0	0.37	0.0	0.0	0.0	0.0	2.00	0.01	0.16	4
CPES65	0.07	0.0	0.0	2.04	1.05	0.10	0.0	0.84	0.44	0.0	5
CPES65	0.0	0.0	0.0	0.0	0.10	0.77	0.0	0.0	0.0	0.0	6
CPES65	1.77	0.0	0.04	0.0	0.07	0.0	0.08	0.0	0.0	0.0	7
CPES65	0.0	0.58	0.07	0.0	0.0	0.0	0.44	0.05	1.07	0.0	8
CPES65	0.0	0.0	0.0	0.0	0.0	0.48	2.46	0.0	0.0	0.0	9
CPES65	0.52	0.0	0.0	0.05	0.41	0.0	0.0	0.0	0.0	0.0	10
CPES65	0.0	0.0	0.0	0.0	0.0	0.19	0.0	0.0	0.0	1.21	11
CPES65	0.0	0.0	0.0	0.0	0.70	0.0	0.11	0.0	0.0	0.0	12
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14
CPES65	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0	0.0	0.63	15
CPES65	0.0	0.0	0.0	0.31	0.14	0.0	0.07	0.0	0.02	0.0	16
CPES65	0.0	0.52	0.59	0.04	0.03	2.06	0.52	0.91	0.0	0.0	17
CPES65	0.0	0.0	0.0	0.0	0.0	1.00	0.85	0.03	0.50	0.30	18
CPES65	0.0	0.90	0.0	0.0	0.0	0.0	0.0	0.11	0.33	0.0	19
CPES65	0.0	0.02	0.02	0.13	0.23	0.0	0.0	0.0	0.0	0.0	20
CPES65	0.0	1.45	0.0	0.0	0.0	0.02	0.0	0.17	1.59	0.0	21
CPES65	0.04	0.0	0.0	0.13	0.0	0.0	0.03	0.03	0.0	0.0	22
CPES65	0.33	0.0	0.0	0.0	0.08	0.0	0.0	0.02	0.0	0.0	23
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.07	24
CPES65	0.03	0.0	0.0	0.0	0.0	0.77	0.02	0.0	0.0	0.0	25
CPES65	0.0	0.0	0.18	0.06	0.0	0.0	0.0	0.0	0.20	0.0	26
CPES65	0.04	0.08	0.0	0.0	0.0	0.09	0.30	1.21	0.0	0.0	27
CPES65	0.73	0.52	0.09	0.30	0.14	0.0	0.0	0.0	0.0	2.08	28
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29
CPES65	0.0	0.0	0.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31
CPES65	0.0	0.0	0.0	0.02	0.0	0.0	0.50	0.0	0.0	0.0	32

Figure 6-3.--Part of the rainfall data set (CREAMS/RAIN.TIFT), option 1 (daily rainfall), page 1 of 2.

(CREAMS/RAIN.TIFT) (continued)

CPES65	0.0	0.0	0.0	0.0	0.0	0.30	0.39	0.0	0.0	0.0	33
CPES65	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34
CPES65	0.0	0.0	0.0	0.0	0.0	0.0	0.29	0.05	0.0	0.23	35
CPES65	0.09	0.0	2.32	0.12	0.0	0.0	0.0	0.0	0.07	0.0	36
CPES65	0.0	0.0	0.0	0.0	0.0						37
CPES66	0.0	0.0	0.0	0.12	0.33	0.56	0.02	0.0	0.0	0.0	1
CPES66	0.0	0.0	0.0	0.17	1.95	0.02	0.0	0.0	0.0	0.0	2
CPES66	0.0	0.77	0.01	0.0	0.0	1.61	0.03	0.0	0.05	0.10	3
CPES66	0.0	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
CPES66	0.0	0.15	1.03	0.85	0.0	0.0	0.0	0.78	0.14	1.22	5
CPES66	0.0	0.0	0.0	0.21	0.39	0.0	0.0	0.28	0.96	1.22	6
CPES66	0.0	0.03	0.0	1.83	0.0	0.0	0.0	0.0	0.0	0.0	7
CPES66	0.0	0.08	0.05	0.06	0.11	0.0	0.0	0.0	0.0	0.0	8
CPES66	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
CPES66	0.0	0.0	0.0	0.33	0.16	0.0	0.0	0.01	0.0	0.0	10
CPES66	0.0	0.0	0.0	0.0	0.51	0.0	0.0	0.0	0.0	0.12	11
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	12
CPES66	0.0	0.0	0.32	0.0	0.0	0.0	0.46	0.43	0.30	0.19	13
CPES66	0.0	0.0	0.0	0.36	0.0	0.0	1.12	0.0	0.09	0.43	14
CPES66	0.45	0.73	0.16	0.0	0.0	0.47	0.04	0.0	0.09	0.0	15
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.34	16
CPES66	2.41	0.0	0.0	0.0	0.0	0.0	0.18	0.58	0.73	0.0	17
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18
CPES66	0.0	0.02	0.08	0.12	0.0	0.0	0.0	0.0	0.0	0.0	19
CPES66	0.58	0.0	0.0	0.0	1.40	0.08	0.30	0.0	1.59	0.0	20
CPES66	0.01	0.0	0.13	0.01	0.0	0.05	0.12	0.0	0.0	0.0	21
CPES66	0.0	0.18	0.0	0.0	0.0	0.0	0.53	0.75	0.22	0.0	22
CPES66	0.08	0.55	0.0	0.18	0.0	0.0	0.0	0.30	0.94	0.0	23
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.01	0.83	25
CPES66	0.0	0.0	0.0	0.0	0.0	0.04	0.0	0.0	0.48	0.0	26
CPES66	0.0	0.43	0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27
CPES66	0.26	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28
CPES66	0.0	0.0	2.11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29
CPES66	0.0	0.89	0.18	0.0	0.0	0.0	0.0	0.02	0.0	0.0	30
CPES66	0.0	0.0	0.0	0.0	0.0	0.98	0.03	0.0	0.0	0.0	31
CPES66	0.0	0.0	0.0	0.0	0.02	1.99	0.0	0.02	0.0	0.0	32
CPES66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33
CPES66	0.0	0.41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34
CPES66	0.0	0.0	0.0	0.04	0.30	0.0	0.05	0.01	0.0	0.0	35
CPES66	0.0	0.54	0.0	0.0	0.0	0.0	0.06	0.19	0.0	0.0	36
CPES66	0.0	0.02	0.67	0.0	0.31						37
CPES67	2.13	1.60	1.44	0.31	0.0	0.0	0.0	0.20	0.49	0.71	1
CPES67	0.08	0.0	0.0	0.24	0.81	0.0	0.0	0.0	0.0	0.0	2
CPES67	0.0	0.0	0.0	0.0	0.0	0.0	0.11	0.0	0.0	0.0	3

(Continued for 10 years of rainfall).

Figure 6-3.--Part of the rainfall data set (CREAMS/RAIN.TIFT), option 1 (daily rainfall), page 2 of 2.

CARD NO										
1	(CREAMS/HYDPAR.TIFT) EXAMPLE APPL'CATION FOR CREAMS USER'S GUIDE									
2	TIFTON GA. CONTINUOUS CORN BASE CONDITION									
3	TIFTON LS SOIL HYDROLOGY									
4	65000	1	1	1		0				
5	72.	.33	.55	.2	3.5	.40	.08			
6	.2	81.	.018	2.9	36.					
7	.32	1.60	1.92	1.92	1.92	1.92	1.92			
8	49.8	51.9	57.8	66.4	73.6	79.8	80.4	80.4	76.4	67.5
9	57.5	50.5								
10	242.5	316.5	403.5	502.5	556.	541.5	510.	495.5	417.	345.5
11	284.0	222.0								
12	1.0									
13	001	0.0								
13	74	0.0								
13	94	.09								
13	114	.19								
13	134	.23								
13	154	.49								
13	174	1.16								
13	194	2.97								
13	214	3.00								
13	234	2.72								
13	254	1.83								
13	274	0.0								
13	366	0.0								
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	-1									

Figure 6-4.--Hydrology parameter file (CREAMS/HYDPAR.TIFT).

Erosion/ Sediment Component

Next, the erosion/sediment yield parameter file is developed. Named (CREAMS/EROPAR.TIFT) (figure 6-5), this file is sent to WCC with (CREAMS/HYDPAS.TIFT) to run the erosion/sediment component.

The erosion sequence is overland-channel. We determine the representative overland flow profile (figure 6-6) after studying 10 different profiles. The channel profile is plotted in figure 6-7. The model run produces a printed output file and an erosion/sediment yield pass file, which we name (CREAMS/EROPAS.TIFT).

CARD NO										
1	(CREAMS/EROPAR.TIFT)			EXAMPLE APPLICATION SCS USER'S GUIDE						
2			EROSION PARAMETER FILE TIFTON GA.							
3			TIFTON LS SOIL BASE CONDITIONS							
4	65	74	1	1	1	3	0	0		
5										
6	.05	.10	.85	.01						
8	72.	1000.0	0.032	.02	.044	.005	325.	23.	720.	6.0
9	1	1.0	.28							
10	3	1	1	2						
11	20.	.05	.015							
12	2165.	72.	5.	20.						
13	305.	.02	1385.	0.009	2165.	.023				
16	1									
17	001	045	069	105	121	135	200	274	283	319
18	1	1.0								
19	.52	.86	.86	.78	.70	.54	.40	.26	.40	.59
20	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
21	.012	.012	.015	.025	.032	.040	.045	.045	.050	.015
22	1	1.0								
23	.030	.030	.035	.045	.055	.060	.060	.060	.050	.035
24	0.2	0.05	.10	0.3	0.4	0.5	0.6	0.6	0.6	0.2
25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
26	0.42	0.42	0.42	0.42	-1.	-1.	-1.	-1.	-1.	0.42
27	-40.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

Figure 6-5.--Erosion parameter file (CREAMS/EROPAR.TIFT). On card 26, the value 0.42 tells the program that cultivation occurred and that the depth of the nonerodible layer was fixed at 0.42 foot.

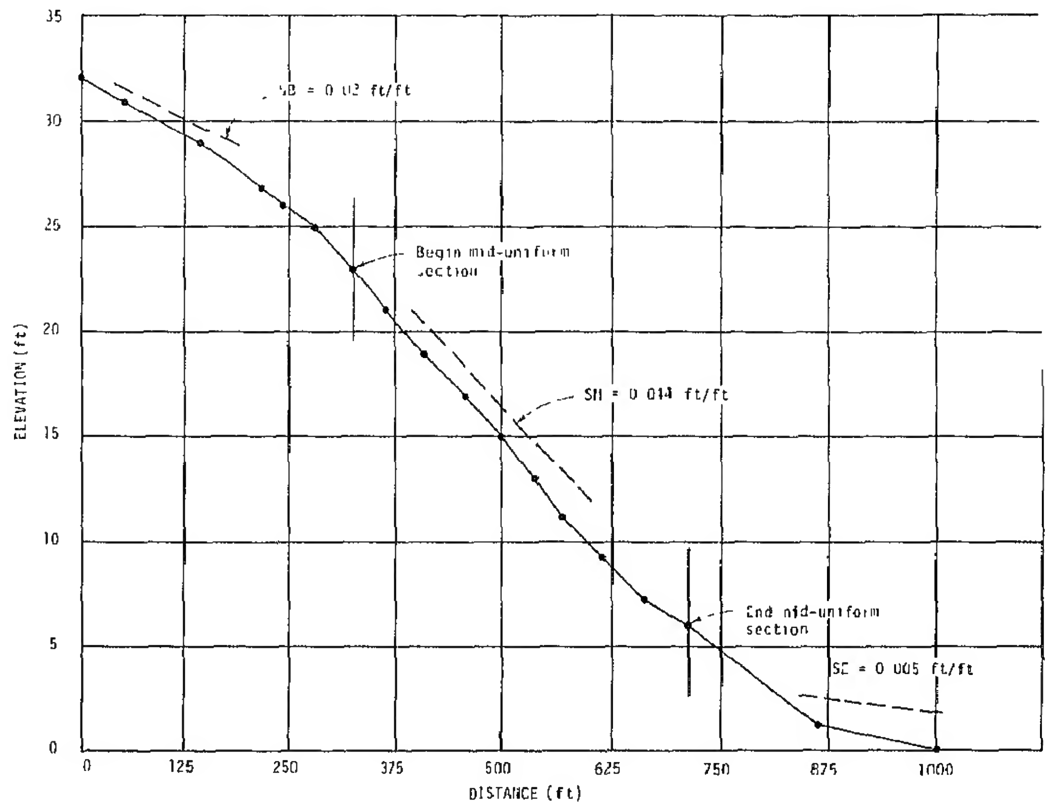


Figure 6-6.--Typical overland flow profile, example application, Tifton, Georgia.

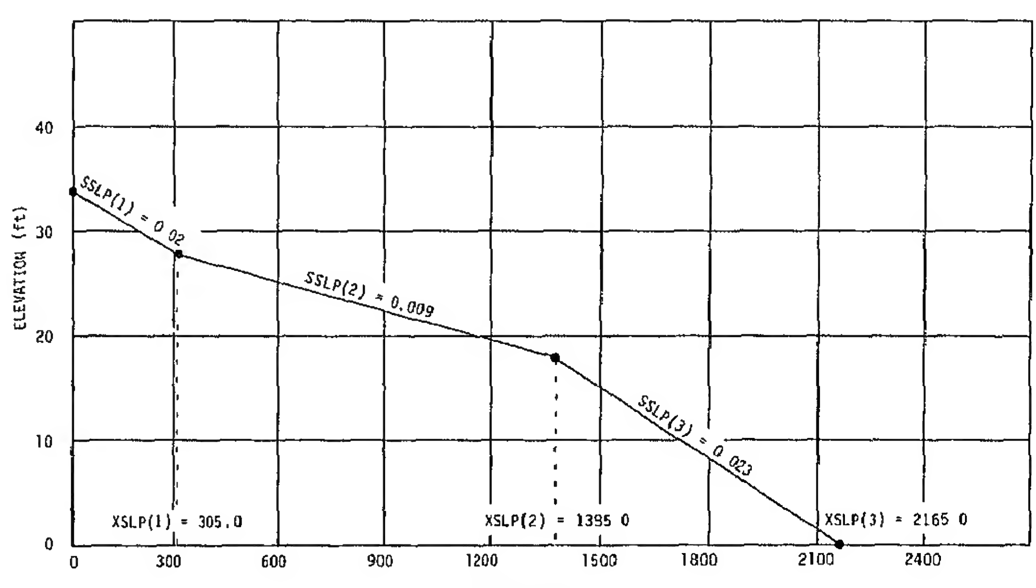


Figure 6-7.--Concentrated flow profile, example application, Tifton, Georgia.

Chemical Component

The erosion/sediment pass file is used with both of the chemical parameter files, that is, the nutrient and the pesticide files. Using field and other available data, we develop the nutrient parameter file (figure 6-8) and call it (CREAMS/NUTPAR.TIFT). Then we develop the pesticide parameter file (figure 6-9) and call it (CREAMS/PESTPAR.TIFT).

CARD NO										
1	(CREAMS/NUTPAR.TIFT)			EXAMPLE APPLICATION SCS USER'S GUIDE						
2			NUTRIENT PARAMETER FILE TIFTON GA.							
3			TIFTON LS SOIL		CORN BASE CONDITION					
4	65000	0	0	0	1	0				
5	0.45	0.21	.5							
6	2									
7	.2	.2	20.	.001	.0005	0.15	0.15	7.4	-.20	7.4
8	-0.2	1.0								
9	65000	66068								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	65069									
13	15.0	30.0	0.1							
12	65121									
13	100.0	0.0	1.0							
9	66069	67068								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	66069									
13	15.0	30.0	0.1							
12	66121									
13	100.0	0.0	1.0							
9	67069	68068								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	67069									
13	15.0	30.0	0.1							
12	67121									
13	100.0	0.0	1.0							
9	68069	69068								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	68069									
13	15.0	30.0	0.1							
12	68121									
13	100.0	0.0	1.0							
9	69069	70068								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	69069									

Figure 6-8.--Nutrient parameter file (CREAMS/NUTPAR.TIFT), page 1 of 2.

We cannot run the chemical model concurrently for both subcomponents, but the outputs from each component run include a printed output file and a punched pass file. With these results, the model runs are complete for the base management system. We can now simulate alternative systems.

(CREAMS/NUTPAR.TIFT) (continued)

CARD NO							
13	15.0	30.0	0.1				
12	69121						
13	100.0	0.0	1.0				
9	70069	71068					
10	2	91	274				
11	914.	6300.0	2.5	120.0	60.	27.	225.
12	70069						
13	15.0	30.0	0.1				
12	70121						
13	100.0	0.0	1.0				
9	71069	72068					
10	2	91	274				
11	914.	6300.0	2.5	120.0	60.	27.	225.
12	71069						
13	15.0	30.0	0.1				
12	71121						
13	100.0	0.0	1.0				
9	72069	73068					
10	2	91	274				
11	914.	6300.0	2.5	120.0	60.	27.	225.
12	72069						
13	15.0	30.0	0.1				
12	72121						
13	100.0	0.0	1.0				
9	73069	74068					
10	2	91	274				
11	914.	6300.0	2.5	120.0	60.	27.	225.
12	73069						
13	15.0	30.0	0.1				
12	73121						
13	100.0	0.0	1.0				
9	74069	74366					
10	2	91	274				
11	914.	6300.0	2.5	120.0	60.	27.	225.
12	74069						
13	15.0	30.0	0.1				
12	74121						
13	100.0	0.0	1.0				
9		0					

Figure 6-8.--Nutrient parameter file (CREAMS/NUTPAR.TIFT), page 2 of 2.

CARD NO										
1	(CREAMS/PESTPAR.TIFT) EXAMPLE APPLICATION SCS USER'S GUIDE									
2		PESTICIDE PARAMETER FILE								
3		TIFTON LS	CORN							
4	65000	0	0	1	0	0	1			
5	0.45	0.21	.5							
6	3	65000	74366							
7	1		ATRAZINE	33.0	0.0	0.1	2.0	0.0	0.0	0.0
7	2		CARBOFURAN	700.0	0.0	0.08	100.0	0.0	0.0	0.0
7	3		SEVIN	40.0	7.0	0.01	100.0	0.0	0.0	0.7
8	1069	1134	2							
9	1	2.8	1.0	1.0	0.0	1.0	0.0			
9	2	2.2	2.0	0.0	0.0	1.0	0.0			
8	1135	1151	1							
9	3	0.4	1.0	1.0	0.15	0.65	0.05			
8	1152	2068	1							
9	3	0.4	1.0	1.0	0.15	0.65	0.05			
8		0								

Figure 6-9.--Pesticide parameter file (CREAMS/PESTPAR.TIFT).

6.2 Alternative Management Systems

Parameter data files can be compiled much faster for the alternative management systems than for the base system, because many of the parameters will be the same. Duplicate the original files and edit them as necessary to fit the alternative.

Two alternative systems are described here. Alternative 1 is the same as the base system except for the addition of a winter cover crop of small grain after the corn is harvested. Alternative 2 is a system of parallel terraces that outlet into a grass waterway in the concentrated flow area.

Alternative 1

For alternative 1, we have to make only three changes in the hydrology parameter file to reflect the addition of a winter cover crop. The Harris operator can help you duplicate the original files so that they are not lost. The three changes are--

1. Change CN2 (card 6) to 79.0 to indicate that a row crop and a small grain crop are grown.

2. Change the GR value (card 12) to 0.5 to indicate that a crop is grown over the winter.

3. Change the AREA values (card 13) to indicate the growth of the small grain in both spring and fall.

We name the new hydrology file (CREAMS/HYDPAR1.TIFT) (see figure 6-10). Then we change the erosion/sediment yield parameter file to reflect the planting, growth, and harvest

```
CARD
 NO
  1   (CREAMS/HYDPAR1.TIFT)       EXAMPLE APPLICATION FOR CREAMS USER'S GUIDE
  2               TIFTON GA.    CONTINUOUS CORN
  3               TIFTON LS SOIL    ALT 1  WINTER COVER
  4     65000       1        1        1               0
  5       72.     .33      .55       .2     3.5     .40     .08
  6        .2     79.     .018      2.9     36.
  7       .32    1.60     1.92     1.92    1.92    1.92    1.92
  8      49.8    51.9     57.8     66.4    73.6    79.8    80.4    80.4    76.4    67.5
  9      57.5    50.5
 10     242.5   316.5    403.5    502.5    556.   541.5    510.   495.5    417.   345.5
 11     284.0   222.0
 12       0.5
 13        01    1.62
 13        15    1.70
 13        29    1.90
 13        44    2.00
 13        58    2.20
 13        60     0.0
 13        74     0.0
 13        94     .09
 13       114     .19
 13       134     .23
 13       154     .49
 13       174    1.16
 13       194    2.97
 13       214    3.00
 13       234    2.72
 13       254    1.83
 13       274     0.0
 13       280     0.0
 13       295    0.47
 13       309    0.90
 13       324    0.90
 13       338    0.90
 13       353    0.90
 13       366    1.62
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14         0       0        0
 14        -1
```

Figure 6-10.--Hydrology parameter file for alternative 1 (CREAMS/HYDPAR1.TIFT).

(or plow-down) of the small grain (figure 6-11). We name the file CREAMS/EROPAR1.TIFT). Next, to show the additional crop being grown, we change the nutrient parameter file, renaming it (CREAMS/NUTPAR1.TIFT)--see figure 6-12. The pesticide file is not changed (figure 6-9) because no pesticides are applied for the winter cover crop. The pesticide file should be run, however, because runoff and sediment yield may be different with winter cover. The pass files received from WCC are named (CREAMS/HYDPAS1.TIFT) and (CREAMS/EROPAS1.TIFT).

CARD NO										
1	(CREAMS/EROPAR1.TIFT)			EXAMPLE APPLICATION SCS USER'S GUIDE						
2		EROSION PARAMETER FILE TIFTON GA.								
3		TIFTON LS SOIL ALT 1 WINTER COVER								
4	65	74	3	0	0	3	0	0		
5										
6	.05	.10	.85	.01						
8	72.	1000.0	0.032	.02	.044	.005	325.	23.	720.	6.0
9	1	1.0	.28							
10	3	1	1	2						
11	20.	.05	.015	2.41	2.25	0.0				
12	2165.	72.	5.	20.						
13	305.	.02	1385.	0.009	2165.	.023				
16	1									
17	001	045	069	105	121	135	200	274	283	319
18	1	1.0								
19	.33	.13	.86	.78	.70	.54	.40	.26	.64	.52
20	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
21	.022	.032	.015	.025	.032	.040	.045	.045	.050	.015
22	1	1.0								
23	.030	.030	.035	.045	.055	.060	.060	.060	.050	.035
24	0.2	0.3	.05	0.1	0.2	0.3	0.4	0.5	0.05	0.2
25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
26	0.42	0.42	0.42	0.42	-1.	-1.	-1.	-1.	-1.	0.42
27	-40.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

Figure 6-11.--Erosion parameter file for alternative 1 (CREAMS/EROPAR1.TIFT).

CARD NO										
1	(CREAMS/NUTPAR1.TIFT) EXAMPLE APPLICATION SCS USER'S GUIDE									
2	NUTRIENT PARAMETER FILE TIFTON GA.									
3	TIFTON LS SOIL CORN ALT 1 WINTER COVER									
4	65000	2	0	0	1					
5	0.45	0.21	.5							
6	2									
7	.2	.2	20.	.001	.0005	0.15	0.15	7.4	-.20	7.4
8	-0.2	1.0								
9	65000	65279								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	65069									
13	15.0	30.0	0.1							
12	65121									
13	100.0	0.0	1.0							
9	65280	66068								
10	0	285	060							
11	914.	3360.	3.7	120.0	50.	8.				
9	66069	66279								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	66069									
13	15.0	30.0	0.1							
12	66121									
13	100.0	0.0	1.0							
9	66280	67068								
10	0	285	060							
11	914.	3360.	3.7	120.0	50.	8.				
9	67069	67279								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	67069									
13	15.0	30.0	0.1							
12	67121									
13	100.0	0.0	1.0							
9	67280	68068								
10	0	285	060							
11	914.	3360.	3.7	120.0	50.	8.				
9	68069	68279								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	68069									
13	15.0	30.0	0.1							
12	68121									
13	100.0	0.0	1.0							
9	68280	69068								
10	0	285	060							
11	914.	3360.	3.7	120.0	50.	8.				
9	69069	69279								
10	2	91	274							
11	914.	6300.0	2.5	120.0	60.	27.	225.			
12	69069									
13	15.0	30.0	0.1							
12	69121									

Figure 6-12.--Nutrient parameter file for alternative 1 (CREAMS/NUTPAR1.TIFT), page 1 of 2.

```
(CREAMS/NUTPAR1.TIFT) (continued)
13     100.0     0.0    1.0
 9     69280   70068
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9     70069   70279
10         2      91    274
11      914.  6300.0    2.5   120.0     60.    27.    225.
12     70069
13      15.0    30.0    0.1
12     70121
13     100.0     0.0    1.0
 9     70280   71068
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9     71069   71279
10         2      91    274
11      914.  6300.0    2.5   120.0     60.    27.    225.
12     71069
13      15.0    30.0    0.1
12     71121
13     100.0     0.0    1.0
 9     71280   72068
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9     72069   72279
10         2      91    274
11      914.  6300.0    2.5   120.0     60.    27.    225.
12     72069
13      15.0    30.0    0.1
12     72121
13     100.0     0.0    1.0
 9     72280   73068
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9     73069   73279
10         2      91    274
11      914.  6300.0    2.5   120.0     60.    27.    225.
12     73069
13      15.0    30.0    0.1
12     73121
13     100.0     0.0    1.0
 9     73280   74068
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9     74069   74279
10         2      91    274
11      914.  6300.0    2.5   120.0     60.    27.    225.
12     74069
13      15.0    30.0    0.1
12     74121
13     100.0     0.0    1.0
 9     74280   74366
10         0     285    060
11      914.   3360.    3.7   120.0     50.     8.
 9        -1
```

Figure 6-12.--Nutrient parameter file for alternative 1 (CREAMS/NUTPAR1.TIFT), page 2 of 2.

Alternative 2

Simulating alternative 2, a terrace system, is more complex, but we can use much of the information already assembled. In the hydrology parameter file, renamed (CREAMS/HYDPAR2.TIFT), we change the curve number (CN2) to 74 (card 6, figure 6-13). Since terraces change the topographic configuration, we also change the hydrologic slope (CHS) and watershed length/width ratio (WLW) on card 6. Since no winter cover will be grown, the GR value (card 12) and AREA values (card 13) are the same as those for the base-system run.

The erosion/sediment yield parameter file requires major changes because terraces change the topography and, therefore, the erosion sequence (card 4). With terraces, overland flow

CARD NO										
1	(CREAMS/HYDPAR2.TIFT)		EXAMPLE APPLICATION FOR CREAMS USER'S GUIDE CARD2:							
2		TIFTON GA.		CONTINUOUS CORN						
3		TIFTON LS SOIL		ALT 2 TERRACES AND WATERWAY						
4	65000	1	1	1		0				
5	72.	.33	.55	.2	3.5	.40	.08			
6	.2	74.	.015	4.44	36.					
7	.32	1.60	1.92	1.92	1.92	1.92	1.92			
8	49.8	51.9	57.8	66.4	73.6	79.8	80.4	80.4	76.4	67.5
9	57.5	50.5								
10	242.5	316.5	403.5	502.5	556.	541.5	510.	495.5	417.	345.5
11	284.0	222.0								
12	1.0									
13	001	0.0								
13	74	0.0								
13	94	.09								
13	114	.19								
13	134	.23								
13	154	.49								
13	174	1.16								
13	194	2.97								
13	214	3.00								
13	234	2.72								
13	254	1.83								
13	274	0.0								
13	366	0.0								
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	0	0	0							
14	-1									

Figure 6-13.--Hydrology parameter file for alternative 2 (CREAMS/HYDPAR2.TIFT).

refers to interterrace flow. Channel 1 is the terrace channel, and a channel 2 is described--for the grass waterway. All the soil information and many other parameters, however, remain the same. This file is (CREAMS/EROPAR2.TIFT); see figure 6-14.

The nutrient and pesticide parameter files for alternative 2 are exactly the same as those for the base system, because there is no change in the crop grown or in any of the fertilizer or chemical applications. When the nutrient and pesticide models are run again, however, sediment yield will differ from that of the base system and alternative 1.

CARD NO										
1	(CREAMS/EROPAR2.TIFT)			EXAMPLE APPLICATION SCS USER'S GUIDE						
2		EROSION PARAMETER FILE TIFTON GA.								
3		TIFTON LS SOIL		TERRACES AND WATERWAY			OVERLAND-CH-CH			
4	65	74	3	1	0	4	0	0		
5										
6	.05	.10	.85	.01						
8	1.6	100.0	0.032	.032	.032	.032	100.	0.0	100.	0.0
9	1	1.0	.28							
10	1	1	1	2						
11	20.	.05	.014							
12	700.	1.6	0.0	20.0						
13	700.	.0001								
10	3	1	1	2						
11	20.	.05	.015							
12	2165.	72.	5.	20.						
13	305.	.02	1385.	0.009	2165.	.023				
16	1									
17	001	045	069	105	121	135	200	274	283	319
18	1	1.0								
19	.52	.86	.86	.78	.70	.54	.40	.26	.40	.59
20	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
21	.012	.012	.015	.025	.032	.040	.045	.045	.050	.015
22	1	1.0								
23	.030	.030	.035	.045	.055	.060	.060	.060	.050	.035
24	0.2	0.05	.10	0.3	0.4	0.5	0.6	0.6	0.6	0.2
25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
26	-0.42	0.42	0.42	0.42	-1.	-1.	-1.	-1.	-1.	0.42
27	-40.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
22	1	1.0								
23	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
24	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
26	-0.42	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	0.42
27	-40.0	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

Figure 6-14.--Erosion parameter file for alternative 2, (CREAMS/EROPAR2.TIFT).

6.3 Evaluating the Base and Alternative Systems

You can compare many of the output values to evaluate the effects of the base and alternative systems on nonpoint source problems. Any output values that contribute to nonpoint source problems, such as sediment, nutrients, or pesticides, can be ranked by system. You can also rank--by system--output values for various periods, for example, average annual values, maximum annual values, average monthly values, maximum monthly values, or maximum event values.

The identified problem dictates the kinds of output values and the periods that you should consider. You should always have identified a problem or goal before you select an alternative. The goal may be to improve or maintain water quality or to reduce the effects of nonpoint source pollution. For the example, however, we have assumed that the goal is to reduce atrazine and phosphorus in runoff.

Table 6-1 summarizes, for a 10-year run, results of the CREAMS simulations described in this chapter. The table shows that the loss of both phosphorus and atrazine would be reduced by either alternative management system. Alternative 2, the terrace system, reduces phosphorus loss much more than alternative 1, since a large part of the phosphorus loss is in the adsorbed (particulate) phase. Atrazine is a relatively soluble chemical and is transported mainly in the dissolved form.

Table 6-1.--CREAMS example application: Total values for a 10-year simulation

Runoff parameter	Unit	Base system	Alternative 1	Alternative 2
Runoff volume	cm	85.3	62.7	37.8
	in	33.6	24.7	14.9
Sediment yield	mt/ha	65.9	51.1	13.2
	t/ac	29.4	22.8	5.9
Nitrogen loss	kg/ha	133.9	99.6	11.0
	lb/ac	119.5	88.8	9.8
Phosphorus loss	kg/ha	60.5	46.1	4.3
	lb/ac	53.9	41.9	3.8
Atrazine loss	g/ha	120.4	92.4	49.6
	lb/ac	0.11	0.08	0.04
Carbofuran loss	g/ha	0.0	0.0	0.0
	lb/ac	0.0	0.0	0.0
Sevin loss	g/ha	91.5	68.7	28.3
	lb/ac	0.08	0.06	0.02

Alternative 2 would provide the greatest reduction in pollutants, but it also would cost much more to install than simply adding a winter cover crop. This fact underscores a major limitation of the CREAMS model. The model can estimate results of "what-if" situations, but it cannot tell us the acceptable level of pollution or predict the desirability of any given alternative from a farmer's point of view. Still, we can use the model to estimate the relative effectiveness of alternative systems, if we first identify the problem, define a target level for reducing pollutant loads, and determine the benefits and costs of each alternative.

APPENDIX A

HYDROLOGY PARAMETER TABLES

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Table A-1.--Julian date calendar

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
Non-leap years: 1/													
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

1/ For leap year, use page A-3.

Table A-1, continued.

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
Leap years: 2/													
1	001	032	061	092	122	153	183	214	245	275	306	336	1
2	002	033	062	093	123	154	184	215	246	276	307	337	2
3	003	034	063	094	124	155	185	216	247	277	308	338	3
4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11
12	012	043	072	103	133	164	194	225	256	286	317	347	12
13	013	044	073	104	134	165	195	226	257	287	318	348	13
14	014	045	074	105	135	166	196	227	258	288	319	349	14
15	015	046	075	106	136	167	197	228	259	289	320	350	15
16	016	047	076	107	137	168	198	229	260	290	321	351	16
17	017	048	077	108	138	169	199	230	261	291	322	352	17
18	018	049	078	109	139	170	200	231	262	292	323	353	18
19	019	050	079	110	140	171	201	232	263	293	324	354	19
20	020	051	080	111	141	172	202	233	264	294	325	355	20
21	021	052	081	112	142	173	203	234	265	295	326	356	21
22	022	053	082	113	143	174	204	235	266	296	327	357	22
23	023	054	083	114	144	175	205	236	267	297	328	358	23
24	024	055	084	115	145	176	206	237	268	298	329	359	24
25	025	056	085	116	146	177	207	238	269	299	330	360	25
26	026	057	086	117	147	178	208	239	270	300	331	361	26
27	027	058	087	118	148	179	209	240	271	301	332	362	27
28	028	059	088	119	149	180	210	241	272	302	333	363	28
29	029	060	089	120	150	181	211	242	273	303	334	364	29
30	030		090	121	151	182	212	243	274	304	335	365	30
31	031		091		152		213	244		305		366	31

2/ For non-leap years, use page A-2.

Table A-1.--Julian date calendar

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
Non-leap years: 1/													
1	001	032	060	091	121	152	182	213	244	274	305	335	1
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9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
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15	015	046	074	105	135	166	196	227	258	288	319	349	15
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18	018	049	077	108	138	169	199	230	261	291	322	352	18
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20	020	051	079	110	140	171	201	232	263	293	324	354	20
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22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
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29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

1/ For leap year, use page A-3.

Table A-1, continued.

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
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2	002	033	062	093	123	154	184	215	246	276	307	337	2
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4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11
12	012	043	072	103	133	164	194	225	256	286	317	347	12
13	013	044	073	104	134	165	195	226	257	287	318	348	13
14	014	045	074	105	135	166	196	227	258	288	319	349	14
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16	016	047	076	107	137	168	198	229	260	290	321	351	16
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19	019	050	079	110	140	171	201	232	263	293	324	354	19
20	020	051	080	111	141	172	202	233	264	294	325	355	20
21	021	052	081	112	142	173	203	234	265	295	326	356	21
22	022	053	082	113	143	174	204	235	266	296	327	357	22
23	023	054	083	114	144	175	205	236	267	297	328	358	23
24	024	055	084	115	145	176	206	237	268	298	329	359	24
25	025	056	085	116	146	177	207	238	269	299	330	360	25
26	026	057	086	117	147	178	208	239	270	300	331	361	26
27	027	058	087	118	148	179	209	240	271	301	332	362	27
28	028	059	088	119	149	180	210	241	272	302	333	363	28
29	029	060	089	120	150	181	211	242	273	303	334	364	29
30	030		090	121	151	182	212	243	274	304	335	365	30
31	031		091		152		213	244		305		366	31

2/ For non-leap years, use page A-2.

Table A-2.--Ranges of effective saturated conductivity (RC) of soils by hydrologic group 1/

Hydrologic group	RC (in/hr)
A	0.30 - 0.45
B	0.15 - 0.30
C	0.05 - 0.15
D	0 - 0.05

1/ From G. W. Musgrave, "How much of the Rain Enters the Soil?" in Water, Yearbook of Agriculture, USDA, 1955, p. 151-159.

Table A-3.--Mean physical properties of soils 1/

Texture	Bulk density	Total porosity (POROS)	Field capacity 1/3 bar	Wilting point 15 bar BR15	AWC	FUL	CONA
	gm/cm^3	-----------	-----------	in/in	-----------	-----------	-----------
Coarse sand	1.6	0.40	0.11	0.03	0.08	0.22	3.3
Sand	1.6(1.50)	0.40(0.45)	0.16(0.09)	0.03(0.02)	0.13(0.07)	0.35(0.16)	3.3
Fine sand	1.5	0.43	0.18	0.03	0.15	0.38	3.3
V. fine sand	1.5	0.43	0.27	0.03	0.24	0.60	3.3
L. coarse sand	1.6	0.40	0.16	0.05	0.11	0.31	3.3
Loamy sand	1.6	0.40	0.19	0.05	0.14	0.40	3.3
Loamy f. sand	1.6	0.40	0.22	0.05	0.17	0.49	3.3
L. v. f. sand	1.6	0.40	0.37	0.05	0.32	0.91	3.3
Coarse s. loam	1.6	0.40	0.19	0.08	0.11	0.34	3.3
Sandy loam	1.6(1.35)	0.40(0.50)	0.22(0.15)	0.08(0.04)	0.14(0.11)	0.44(0.24)	3.5
F. sandy loam	1.7	0.36	0.27	0.08	0.19	0.68	3.5
V. f. sandy loam	1.6	0.40	0.37	0.08	0.29	0.91	3.5
Loam	1.6	0.40	0.26	0.11	0.15	0.52(0.33)	4.5
Silt loam	1.5(1.25)	0.43(0.53)	0.32(0.22)	0.12(0.07)	0.20(0.15)	0.64(0.33)	4.5
Silt	1.4	0.47	0.27	0.03	0.24	0.55	4.0
Sandy clay loam	1.6	0.40	0.30	0.18	0.12	0.54	4.0
Clay loam	1.6(1.20)	0.40(0.55)	0.35(0.28)	0.22(0.10)	0.13(0.18)	0.72(0.40)	4.0
Silty clay loam	1.4	0.47	0.36	0.20	0.16	0.59	4.0
Sandy clay	1.6	0.40	0.28	0.20	0.08	0.40	3.5
Silty clay	1.5	0.43	0.40	0.30	0.10	0.77	3.5
Clay	1.4(1.15)	0.47(0.60)	0.39(0.45)	0.28(0.33)	0.11(0.12)	0.58(0.44)	3.5

1/ Adapted from C. B. England, "Land capabilities: A hydrologic response unit in agricultural watersheds," USDA, ARS 41-172, September 1970. The values are averages; local data should be used when available. (The values in parentheses are calculated to reflect the different bulk densities.)

Table A-4.--Runoff curve numbers for hydrologic soil-cover complexes for antecedent moisture condition II and $I_a = 0.2S$ 1/

Land use	Treatment or practice	Hydrologic condition	Hydrologic soil group A	B	C	D
Fallow	Straight row		77	86	91	94
	Straight row + conserv. till.	poor 2/	75	84	89	92
	Straight row + conserv. till.	good 3/	74	83	87	90
Row crops	Straight row	poor	72	81	88	91
	Straight row	good	67	78	85	89
	Straight row + conserv. till.	poor 2/	71	79	86	89
	Straight row + conserv. till.	good 3/	64	75	82	85
	Contoured	poor	70	79	84	88
	Contoured	good	65	75	82	86
	Contoured + conserv. till.	poor 2/	69	78	83	87
	Contoured + conserv. till.	good 3/	64	74	80	84
	Contoured + terraces	poor	66	74	80	82
	Contoured + terraces	good	62	71	78	81
	Contoured + terraces + conserv. till.	poor 2/	65	73	79	81
	Contoured + terraces + conserv. till.	good 3/	61	70	76	79
Small grains	Straight row	poor	65	76	84	88
	Straight row	good	63	75	83	87
	Straight row + conserv. till.	poor 2/	64	74	82	86
	Straight row + conserv. till.	good 3/	60	72	80	84
	Contoured	poor	63	74	82	85
	Contoured	good	61	73	81	84
	Contoured + conserv. till.	poor 2/	62	73	81	84
	Contoured + conserv. till.	good 3/	60	72	79	82
	Contoured + terraces	poor	61	72	79	82
	Contoured + terraces	good	59	70	78	81
	Contoured + terraces + conserv. till.	poor 2/	60	71	78	81
	Contoured + terraces + conserv. till.	good 3/	58	69	76	79
Close-seeded legumes 4/ or rotation meadow	Straight row	Poor	66	77	85	89
	Straight row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Contoured + terraces	Poor	63	73	80	83
	Contoured + terraces	Good	51	67	76	80

(continued)

Table A-4, continued.

Land use	Treatment or practice	Hydrologic condition	Hydrologic soil group A	B	C	D
Pasture or range	---	Poor	68	79	86	89
	---	Fair	49	69	79	84
	---	Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow	---	Good	30	58	71	78
Woods	---	Poor	45	66	77	83
	---	Fair	36	60	73	79
	---	Good	25	55	70	77
Farmsteads	---	----	59	74	82	86
Roads 5/	Dirt	----	72	82	87	89
	Hard surface	----	74	84	90	92

1/ Adapted from Walter J. Rawls and H. H. Richardson, "Runoff curve numbers for conservation tillage," 1983, Journal of Soil and Water Conservation, 38(6): 494-496.

2/ Residue cover is less than 20% of the surface (less than 750 lb/acre for row crops or 300 lb/acre for small grain).

3/ Residue cover is more than 20% of the surface; normal range is 20 to 40%.

4/ Close-drilled or broadcast.

5/ Including right-of-way.

Table A-5.--Runoff curve numbers for selected range sites by range condition class, antecedent moisture condition I

Range site	Curve number by range condition Poor	Fair	Good
Wetland	95	95	95
Very shallow	95	90	85
Saline subirrigated	90	90	85
Subirrigated	90	90	85
Shale	90	85	80
Dense clay	90	85	80
Alkali clay	90	85	80
Saline upland	90	85	80
Igneous	90	80	75
Shallow clayey	85	80	75
Shallow sandy	80	75	70
Shallow loamy	80	75	70
Shallow igneous	80	75	70
Steep clayey	80	75	70
Clayey	80	75	65
Gravelly loamy	80	75	65
Steep loamy	80	75	65
Overflow	80	70	60
Loamy overflow	80	70	60
Clayey overflow	80	70	60
Coarse upland	80	70	60
Limy upland	80	70	60
Shallow breaks	80	70	60
Stony	80	70	60
Steep stony	80	70	60
Lowland	80	70	60
Saline lowland	80	70	60
Loamy lowland	80	65	55
Loamy	80	65	55
Sandy lowland	75	60	50
Sandy	75	60	50
Gravelly	70	55	45
Sands	70	55	40
Choppy sands	70	55	40

1/ Site conditions are general; adjust (interpolate) the curve number to fit particular sites on the basis of field investigation. Use local procedure in conversion to antecedent moisture condition II or refer to CRR 26, p. 398-403.

Table A-6.--Estimates for parameters RC and GA, hydrology option 2 1/

Land use	Hydrologic condition	RC (in/hr) by hydrologic soil group 2/ and expected range of values				GA (in) by hydrologic soil group and expected range of values 3/			
		A (0.3-3.0)	B (0.1-1.0)	C (0.05-0.5)	D (0.01-0.2)	A (3-6)	B (7-11)	C (12-17)	D (18-22)
Row crops:									
Straight	Poor	0.4 4/	0.18	0.06	0.03				
	Good	.45	.21	.09	.04				
Contoured	Poor	.4	.2	.1	.05				
	Good	.5	.25	.12	.07				
Fallow	----	.3	.12	.04	.02				
Small grains and meadow:									
Straight	Poor	.05	.22	.09	.04				
	Good	.6	.43	.12	.07				
Contoured	Poor	.05	.25	.1	.07				
	Good	.65	.3	.14	.09				
Range/pasture:									
Straight	Poor	.5	.2	.08	.04				
	Good	.8	.42	.2	.12				
Contoured	Poor	.75	.35	.13	.04				
	Good	2.0	.7	.24	.12				
Meadow:	Good	1.2	.46	.23	.13				
Woods:	Poor	.75	.36	.17	.09				
	Good	1.5	.50	.24	.14				

1/ Tentative estimates.
2/ Terrace systems are omitted since they affect runoff routing, not condition of soil.
3/ Means for estimation of GA: Hydrologic group A, 4; B, 9; C, 15; D, 20.
4/ Values given will reproduce CN estimates for a storm of 4.0 inches lasting 4 hours, with mean value of GA.

Table A-7.--Mean daily solar radiation (langleys/day) and years of record used
[From CRR 26, p. 180-182]

States and stations	JAN	YRS	FEB	YRS	MAR	YRS	APR	YRS	MAY	YRS	JUNE	YRS	JULY	YRS	AUG	YRS	SEPT	YRS	OCT	YRS	NOV	YRS	DEC	YRS	ANNUAL
ALASKA																									
Annette----------------	63	6	115	6	236	7	364	7	437	6	438	6	438	6	341	6	258	7	122	7	59	7	41	7	243
Bethel-----------------	38	9	108	10	282	9	444	10	457	10	454	10	376	10	252	10	202	10	115	10	44	9	22	9	233
Fairbanks--------------	16	25	71	27	213	25	376	28	461	28	504	29	434	28	317	29	180	29	82	30	26	29	6	26	224
ARIZONA																									
Page-------------------	300	2	382	3	526	3	618	2	695	2	707	2	680	3	596	3	516	3	402	3	310	3	243	3	498
Phoenix----------------	301	11	409	11	526	11	638	11	724	11	739	11	658	11	613	11	566	11	449	11	344	11	281	11	520
Tucson-----------------	315	5	391	5	540	4	655	5	729	5	699	5	626	6	588	6	570	6	442	6	356	6	305	6	518
ARKANSAS																									
Little Rock------------	188	9	260	9	353	10	446	9	523	9	559	9	556	8	518	9	439	7	343	8	244	10	187	10	385
CALIFORNIA																									
Davis------------------	174	18	257	17	390	18	528	18	625	18	694	18	682	18	612	18	493	18	347	19	222	19	148	19	431
Fresno-----------------	184	31	289	31	427	31	552	31	647	31	702	32	682	32	621	31	510	31	376	32	250	31	161	32	450
Inyokern (China Lake)	306	11	412	11	562	11	683	11	772	11	819	11	772	11	729	10	635	8	467	9	363	11	300	12	568
La Jolla---------------	244	19	302	18	397	19	457	20	506	19	487	21	497	22	464	22	369	22	320	21	277	20	221	20	380
Los Angeles WBAS-------	248	10	331	10	470	10	515	10	572	9	596	9	641	9	581	10	503	10	373	10	289	10	241	10	463
Riverside--------------	275	8	367	8	478	9	541	9	623	9	680	9	673	9	618	9	535	9	407	9	319	9	270	9	483
Santa Maria------------	263	11	346	11	482	11	552	10	635	11	694	11	680	11	613	11	524	11	419	11	313	11	252	11	481
Soda Springs-----------	223	4	316	3	374	4	551	4	615	3	691	4	760	3	681	3	515	3	357	4	248	4	182	3	459
COLORADO																									
Boulder----------------	201	5	268	4	401	4	460	4	460	4	525	5	520	5	439	5	412	4	310	4	222	4	182	4	367
Grand Junction---------	227	9	324	9	434	8	546	8	615	9	708	8	676	8	595	8	514	8	373	10	260	10	212	10	456
Grand Lake (Granby)--	212	6	313	7	423	7	512	8	552	8	632	8	600	8	505	7	476	6	361	7	234	6	184	7	417
American Univ.--------	158	39	231	39	322	39	398	39	467	39	510	39	496	39	440	38	364	38	278	38	192	39	141	39	333
FLORIDA																									
Apalachicola-----------	298	10	367	10	441	10	535	10	603	9	578	9	529	9	511	9	456	9	413	10	332	10	262	10	444
Belle Isle-------------	297	10	330	10	412	10	463	10	483	10	464	10	488	11	561	10	400	10	366	11	313	11	291	10	397
Gainesville------------	267	11	343	10	427	12	517	12	579	12	521	10	488	10	483	8	418	9	347	8	300	10	233	10	410
Miami Airport----------	349	10	415	9	489	9	540	10	553	10	532	10	532	10	505	10	440	10	384	10	353	10	316	10	451
Tampa------------------	327	8	391	8	474	8	539	8	596	8	574	9	534	9	494	9	452	9	400	9	356	9	300	9	453
GEORGIA																									
Atlanta----------------	218	11	290	11	380	11	488	11	533	11	562	11	532	10	508	10	416	10	344	11	368	11	211	11	396
Griffin----------------	234	9	295	9	385	10	522	11	570	11	577	11	556	11	522	11	435	11	368	11	283	11	201	11	413

Table A-7, continued.

States and stations	JAN	YRS	FEB	YRS	MAR	YRS	APR	YRS	MAY	YRS	JUNE	YRS	JULY	YRS	AUG	YRS	SEPT	YRS	OCT	YRS	NOV	YRS	DEC	YRS	ANNUAL
HAWAII																									
Honolulu------------	363	4	422	4	516	4	559	5	617	5	615	5	615	5	612	5	573	5	507	5	426	5	371	5	516
Pearl Harbor---------	359	5	400	4	487	4	529	5	573	5	566	5	598	5	567	5	539	5	466	5	386	5	343	5	484
IDAHO																									
Boise---------------	138	10	236	9	342	9	485	9	585	10	636	9	670	10	576	10	460	10	301	11	182	11	124	11	395
Twin Falls-----------	163	20	240	20	355	20	462	21	552	20	592	18	602	20	540	20	432	19	286	20	176	20	131	19	378
ILLINOIS																									
Chicago--------------	96	19	147	19	227	19	331	19	424	19	458	18	473	19	403	18	313	19	207	20	120	20	76	20	273
Lemont---------------	170	6	242	6	340	6	402	6	506	6	553	6	540	6	498	6	398	5	275	5	165	5	138	5	352
INDIANA																									
Indianapolis---------	144	10	213	10	316	10	396	10	488	9	543	11	541	10	490	11	405	11	293	11	177	11	132	11	345
IOWA																									
Ames-----------------	174	5	253	5	326	5	403	5	480	5	541	5	536	6	460	6	367	6	274	7	167	7	143	7	345
KANSAS																									
Dodge City-----------	255	7	316	7	418	7	528	7	568	7	650	7	642	8	592	9	493	9	380	9	285	10	234	10	447
Manhattan------------	192	3	264	3	345	3	433	3	527	4	551	4	531	4	526	4	410	4	492	4	227	4	156	4	371
KENTUCKY																									
Lexington------------	172	9	263	9	357	10	480	10	581	10	628	9	617	10	563	10	494	10	357	9	245	9	174	11	411
LOUISIANA																									
Lake Charles---------	245	11	306	11	397	11	481	11	555	11	591	11	526	11	511	11	449	11	402	11	300	10	250	10	418
New Orleans----------	214	14	259	14	335	15	412	16	449	14	443	13	417	15	416	15	383	15	357	13	278	13	198	14	347
Shreveport-----------	232	3	292	3	384	3	446	4	558	4	557	4	578	4	528	4	414	4	354	4	254	4	205	4	400
MAINE																									
Caribou--------------	133	8	231	9	364	8	400	10	476	10	470	10	508	11	448	11	336	11	212	11	111	11	107	9	316
Portland-------------	152	7	235	8	352	7	409	8	514	9	539	9	561	9	488	8	383	7	278	9	157	8	137	9	350
MASSACHUSETTS																									
Blue Hill------------	153	27	228	27	319	26	389	26	469	27	510	27	502	26	449	27	354	28	266	28	162	28	135	28	328
Boston---------------	129	16	194	17	290	17	350	17	445	16	483	16	486	16	411	16	334	17	235	16	136	16	115	15	301
East Wareham---------	140	13	218	13	305	12	385	14	452	14	508	14	495	14	436	14	365	13	258	14	163	14	140	13	322
MICHIGAN																									
East Lansing---------	121	10	210	11	309	11	359	11	483	10	547	11	540	11	466	11	373	11	255	11	136	11	108	11	311
Sault Ste Marie------	130	10	225	9	356	10	416	10	523	10	557	11	573	11	472	10	322	10	216	9	105	9	96	9	333
MINNESOTA																									
St Cloud-------------	168	8	260	8	368	8	426	8	496	8	535	8	657	9	486	8	366	8	237	7	146	8	124	8	348
MISSOURI																									
Columbia-------------	173	10	251	10	340	11	434	11	530	11	574	12	574	10	522	10	453	10	322	10	225	10	158	9	380

Table A-7, continued.

States and stations	JAN	YRS	FEB	YRS	MAR	YRS	APR	YRS	MAY	YRS	JUNE	YRS	JULY	YRS	AUG	YRS	SEPT	YRS	OCT	YRS	NOV	YRS	DEC	YRS	ANNUAL
MONTANA																									
Glasgow-------------	154	6	258	8	385	7	466	8	568	6	606	8	645	9	531	10	410	10	267	6	154	8	116	7	386
Great Falls----------	140	8	232	9	366	9	434	8	528	8	583	8	639	9	532	9	407	10	264	10	154	10	112	10	366
Summit---------------	122	3	162	2	268	3	414	3	462	3	493	3	560	2	510	2	354	2	216	2	102	2	76	2	312
NEBRASKA																									
Lincoln--------------	188	39	259	39	350	39	416	39	494	40	544	38	568	38	484	38	396	38	296	36	199	40	159	39	363
North Omaha----------	193	3	299	3	365	3	463	3	516	3	546	4	668	4	419	4	410	4	298	4	204	4	170	4	379
NEVADA																									
Ely------------------	236	7	339	9	468	9	563	9	625	10	712	10	647	11	618	11	518	11	394	10	289	10	218	10	465
Las Vegas------------	277	11	384	11	519	11	621	11	702	11	748	10	675	11	627	11	551	11	429	11	318	11	258	11	509
NEW JERSEY																									
Seabrook-------------	157	8	227	8	318	8	403	8	482	9	527	8	509	8	455	9	385	9	278	7	192	8	140	[illegible]	339
NEW MEXICO																									
Albuquerque----------	303	13	386	13	511	13	618	13	686	13	726	13	683	12	626	13	554	14	438	15	334	15	276	14	512
NEW YORK																									
Ithaca---------------	116	22	194	21	272	23	324	23	440	24	501	23	515	23	453	23	346	21	231	22	120	23	96	22	302
Central Park---------	130	34	199	34	290	33	369	35	432	35	470	34	459	35	389	35	331	36	242	36	147	36	115	[illegible]	298
Sayville-------------	160	11	249	11	335	10	415	10	494	10	565	10	453	10	462	10	385	10	289	10	166	10	142	11	352
Schenectady----------	130	8	200	9	273	9	338	9	413	9	448	8	441	8	397	8	299	8	218	8	128	[illegible]	104	8	282
Upton----------------	155	8	232	8	339	8	428	8	502	8	573	8	543	7	475	7	391	7	293	6	182	7	143	[illegible]	355
NORTH CAROLINA																									
Greensboro-----------	200	7	276	9	354	9	469	9	531	10	564	10	544	10	485	10	406	10	322	10	243	10	197	8	383
Hatteras-------------	238	10	317	9	426	8	569	9	635	10	652	10	625	10	562	11	471	11	358	11	282	11	214	11	443
NORTH DAKOTA																									
Bismarck-------------	157	7	250	8	356	6	447	6	550	8	590	9	617	10	516	11	390	11	272	11	161	10	124	10	369
OHIO																									
Cleveland------------	125	6	183	6	303	7	286	8	502	8	562	8	562	8	494	8	278	8	289	9	141	9	115	[illegible]	335
Columbus-------------	128	7	200	7	297	7	391	7	471	6	562	4	542	5	477	4	422	4	286	4	176	4	129	5	340
Put-in-Bay-----------	126	10	204	9	302	10	386	11	468	11	544	11	561	10	487	10	382	11	275	11	144	11	109	11	332
OKLAHOMA																									
Oklahoma City--------	251	10	319	10	409	9	494	10	536	10	615	7	610	8	593	8	487	9	377	10	291	9	240	9	436
Stillwater-----------	205	8	289	8	390	9	454	9	504	9	600	10	596	10	545	10	455	11	354	10	269	[illegible]	[illegible]	[illegible]	405
OREGON																									
Astoria--------------	90	7	162	8	270	8	375	8	492	8	469	8	539	8	461	7	354	7	209	8	[illegible]	8	79	8	301
Corvallis------------	89	2	*		287	3	406	3	517	3	570	3	676	4	558	4	397	4	235	4	114	4	80	4	---
Medford--------------	116	11	215	11	336	11	482	11	592	11	652	11	698	10	605	11	447	11	279	11	149	11	93	11	389

Table A-7, continued.

States and stations	JAN	YRS	FEB	YRS	MAR	YRS	APR	YRS	MAY	YRS	JUNE	YRS	JULY	YRS	AUG	YRS	SEPT	YRS	OCT	YRS	NOV	YRS	DEC	YRS	ANNUAL
PENNSYLVANIA																									
Pittsburgh----------	94	6	169	5	216	6	317	6	429	6	491	6	497	7	409	6	339	6	207	5	118	6	77	5	280
State College-------	133	19	[illegible]	19	295	20	360	20	456	20	518	20	511	20	444	20	358	20	256	20	149	20	118	20	318
RHODE ISLAND																									
Newport-------------	155	23	232	22	334	23	405	23	477	23	527	24	513	24	455	24	377	24	271	24	176	24	139	24	338
SOUTH CAROLINA																									
Charleston----------	252	11	314	11	388	11	512	11	551	11	564	11	520	11	501	11	404	11	338	11	286	11	225	11	404
SOUTH DAKOTA																									
Rapid City----------	183	11	277	11	400	11	482	11	532	11	585	11	590	11	541	11	435	11	315	10	204	10	158	10	392
TENNESSEE																									
Nashville-----------	149	18	228	19	322	19	432	19	503	18	551	18	530	17	473	17	403	17	308	19	208	18	150	19	355
Oak Ridge-----------	161	11	239	11	331	11	450	11	518	11	551	11	526	11	478	11	416	11	318	11	213	10	163	11	364
TEXAS																									
Brownsville---------	297	10	341	10	402	10	456	11	564	10	610	9	627	8	568	11	475	11	411	11	296	11	263	10	442
El Paso-------------	333	11	430	11	547	10	654	11	714	11	729	11	666	11	640	10	576	11	460	11	372	11	313	11	536
Fort Worth----------	250	11	320	11	427	11	488	11	562	11	651	11	613	11	593	11	503	11	403	11	306	11	245	9	445
Midland-------------	283	7	358	8	476	9	550	8	611	8	617	8	608	7	574	8	522	9	396	9	325	8	[illegible]	8	466
San Antonio---------	279	9	347	9	417	9	445	9	541	9	612	9	639	9	585	9	493	10	398	10	295	10	256	8	442
UTAH																									
Flaming Gorge-------	238	2	498	2	443	2	522	2	565	2	650	2	599	3	538	3	425	3	352	3	262	3	215	3	426
Salt Lake City------	163	8	256	8	354	8	479	8	570	7	621	7	620	6	551	7	446	8	316	8	204	6	146	9	394
VIRGINIA																									
Mt. Weather---------	172	2	274	2	338	2	414	2	508	2	525	3	510	3	430	3	375	3	281	2	202	2	168	2	350
Friday Harbor-------	87	8	157	7	274	8	418	8	514	9	576	10	586	10	507	11	351	8	194	10	102	10	75	8	320
WASHINGTON																									
Prosser-------------	117	4	222	4	351	4	521	5	616	4	680	4	707	4	604	4	458	4	274	4	136	4	100	4	399
University of Washington--------	67	9	126	9	245	10	364	9	445	10	461	10	496	11	435	10	299	8	170	9	93	9	59	9	272
Pullman-------------	121	4	205	2	304	2	462	2	558	4	653	5	699	5	562	4	410	4	245	5	146	5	96	5	372
Seattle-Tacoma------	75	9	139	9	265	9	403	9	503	9	511	9	566	9	452	10	324	10	188	10	104	9	64	10	300
WISCONSIN																									
Madison-------------	148	46	220	46	313	45	394	47	466	47	514	47	531	47	452	47	348	47	241	47	145	44	115	46	324
WYOMING																									
Lander--------------	226	8	324	9	452	9	548	11	587	11	678	11	651	11	586	10	472	6	354	9	239	9	196	9	443
Laramie-------------	216	3	295	3	424	3	508	3	554	3	643	3	606	3	536	3	438	3	324	3	229	3	186	4	408
PUERTO RICO																									
San Juan------------	404	5	481	4	580	4	622	4	519	5	536	6	639	5	549	6	531	6	460	6	411	6	411	6	512

Table A-8.--Typical leaf area index (AREA value) distributions for crops 1/

Portion of growing season	Leaf area index 2/							
	Corn	Cotton	Sorghum	Oats	Wheat	Pasture 3/	Barley	Soy-beans
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.1	.09	.13	.09	.42	.47	1.84	.44	.15
.2	.19	.28	.19	.84	.90	3.00	.88	.40
.3	.23	1.05	.23	.90	.90	3.00	.90	2.18
.4	.49	2.14	.54	.90	.90	3.00	.90	2.97
.5	1.16	2.96	1.35	.98	.90	3.00	1.58	3.00
.6	2.97	3.00	2.98	2.62	1.62	3.00	3.00	2.96
.7	3.00	2.96	3.00	3.00	3.00	2.70	3.00	2.92
.8	2.72	2.92	2.72	3.00	3.00	1.96	3.00	2.30
.9	1.83	1.78	1.84	3.00	0.96	2.14	1.15	2.00
1.0	.00	1.00	1.00	.00	.00	.50	.00	.50

1/ From CRR 26, p. 183.

2/ Good production assumed for all crops. AREA value should be multiplied by 0.83 for good management, 0.67 for fair management, and 0.5 for poor management. Leaf area index is defined as the area (m^2) of all leaves and stem within one meter square.

3/ No grazing assumed. If pasture is grazed or mown, AREA value must be lowered according to forage remaining during grazing or after mowing.

APPENDIX B

EROSION/SEDIMENT PARAMETER TABLES

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Table B-1.--Kinematic viscosity (KINVIS) for water over a typical range of temperatures 1/

Temperature (°F.)	Kinematic viscosity	Format for KINVIS input
	($ft^2/sec \times 10^{-5}$)	
40	1.67	1.67E-05
50	1.41	1.41E-05
60	1.21	1.21E-05
70	1.05	1.05E-05
80	0.90	0.90E-05
90	0.82	0.82E-05
100	0.74	0.74E-05

1/ Adapted from CRR 26, p. 223.

Table B-2.--Estimates of Manning's "n" (RMN and NFACT) for overland flow and soil covers 1/

Treatment	Manning's "n"
Cornstalk residue:	
Applied to fallow surface--	
1 ton/acre	0.020
2 ton/acre	.040
4 ton/acre	.070
Disk-harrow incorporated--	
1 ton/acre	.012
2 ton/acre	.020
4 ton/acre	.023
Small grain (20% to maturity):	
Across slope--	
Poor stand	.018
Moderate stand	.023
Good stand	.032
Dense stand	.046
Up and down slope--	
Poor stand	.012
Moderate stand	.015
Good stand	.023
Dense stand	.032
Rough surface depressions:	
4 to 5 inches deep	.046
2 to 4 inches deep	.023
1 to 2 inches deep	.014
No surface depressions	.010

Treatment	Manning's "n"
Wheat straw mulch:	
0.25 ton/acre	0.015
0.5 ton/acre	.018
1 ton/acre	.032
2 ton/acre	.070
4 ton/acre	.074
Crushed stone mulch:	
15 ton/acre	.012
60 ton/acre	.023
135 ton/acre	.046
240 ton/acre	.074
375 ton/acre	.074
Grass:	
Sparse	.015
Poor	.023
Fair	.032
Good	.046
Excellent	.074
Dense	.150
Very dense	.400

1/ Adapted from CRR 26, p. 241.

Table B-3.--Bulk and weight densities in areas of concentrated flow 1/

Condition	Bulk density	Weight density (WTDSOI)
	(g/cm^3)	(lb/ft^3)
Loose.	1.20	75.0
Not subject to compaction and tilled regularly with primary tillage equipment.	1.37	85.0
Subject to compaction and tilled regularly with primary tillage equipment.	1.54	96.0
Not subject to compaction and not tilled regularly with primary tillage equipment.	1.54	98.0
Subject to compaction and not tilled regularly.	1.65	103.0

1/ From CRR 26, p. 224.

Table B-4.--Average fraction of particle size distribution for topsoil textures for use in CREAMS model 1/

USDA Classification	Sand (SOLSND)	Silt (SOLSLT)	Clay (SOLCLY)
Clay	0.20	0.30	0.50
Silty clay	0.10	0.45	0.45
Sandy clay	0.50	0.10	0.40
Clay loam	0.35	0.30	0.35
Silty clay loam	0.15	0.50	0.35
Sandy clay loam	0.55	0.20	0.25
Loam	0.45	0.35	0.20
Silt loam	0.20	0.60	0.20
Sandy loam	0.60	0.25	0.15
Silt	0.05	0.85	0.10
Loamy sand	0.84	0.08	0.08
Sand	0.90	0.05	0.05

1/ Use local values if available.

Table B-5.--Estimates of Manning's "n" (NBARCH, NCHAN, and CTLN) for channel flow and typical soil covers 1/

Cover	Cover density	Manning's "n" 2/
Smooth, bare soil; roughness elements	Less than 1 in deep	0.030
	1-2 in deep	.033
	2-4 in deep	.038
	4-6 in deep	.045
Corn stalks (assumes residue stays in place and is not washed away)	1 ton/acre	.050
	2 tons/acre	.075
	3 tons/acre	.100
	4 tons/acre	.13
Wheat straw (assumes residue stays in place and is not washed away)	1 ton/acre	.060
	1.5 tons/acre	.100
	2 tons/acre	.15
	4 tons/acre	.25
Grass (assumes that grass is erect and that flow depth does not exceed height of grass)	Sparse	.04
	Poor	.05
	Fair	.06
	Good	.08
	Excellent	.13
	Dense	.20
	Very dense	.30
Small grain (20% to maturity)		
Rows with flow	Poor, 7-in rows	.13
	Poor, 14-in rows	.13
	Good, 7-in rows	.30
	Good, 14-in rows	.20
Rows across flow	Good	.30
Sorghum and cotton	Poor	.07
	Good	.09
Sudangrass	Good	.20
Lespedeza	Good	.10
Lovegrass	Good	.15

1/ From CRR 26, p. 248.

2/ Does not include effects of submergence or product of velocity-hydraulic radius.

Table B-6.--Sediment particle characteristics 1/

Condition	Diameter (DIAM)	Particle density	Fraction in detached sediment (FRAC)	Particle
	(mm)	(g/cm^3)		
Soils with ratio of silt to sand & clay that is greater than 0.5 (sa 15%, si 60%, cl 5%).	a. 0.002	2.60	0.05	Primary clay.
	b. .010	2.65	.08	Primary silt.
	c. .020	1.80	.50	Small aggregate.
	d. .500	1.60	.31	Large aggregate.
	e. .200	2.65	.06	Primary sand.
High clay soils (sa 10%, si 40%, cl 50%).	a. .002	2.60	.10	Primary clay.
	b. .010	2.65	.06	Primary silt.
	c. .075	1.80	.57	Small aggregate.
	d. 1.000	1.60	.25	Large aggregate.
	e. .200	2.65	.02	Primary sand.
High sand soils (sa 75%, si 15%, cl 10%).	a. .002	2.60	.02	Primary clay.
	b. .010	2.65	.02	Primary silt.
	c. .030	1.80	.16	Small aggregate.
	d. .200	1.60	.20	Large aggregate.
	e. .200	2.65	.60	Primary sand.

1/ From CRR 26, p. 226.

Table B-7.--Soil loss ratios (CFACT) to describe the effects of cropping management 1/

Line No.	Cover, crop sequence, and management 1/	Spring residue 2/	Cover after plant 3/	Soil loss ratio 4/ for cropstage period and canopy cover 5/							
				F	SB	1	2	3:80	90	96	4L 6/
		Lb	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
	CORN AFTER C, GS, G, OR COT IN MEADOWLESS SYSTEMS										
	Moldboard plow, conv till:										
1	Rdl, sprg TP	4,500	---	31	55	48	38	---	---	20	23
		3,400	---	36	60	52	41	---	24	20	30
3		2,600	---	43	64	56	43	32	25	21	37
4		2,000	---	51	68	60	45	33	26	22	47
5	Rdl, fall TP	HP 2/	---	44	65	53	38	---	---	20	---
6		GP	---	49	70	57	41	---	24	20	---
7		FP	---	57	74	61	43	32	25	21	---
8		LP	---	65	78	65	45	32	26	22	---
9	RdR, sprg TP	HP	---	66	74	65	47	---	---	22	56 7/
10		GP	---	67	75	66	47	---	27	23	62
11		FP	---	68	76	67	48	35	27	---	69
12		LP	---	69	77	68	49	35	---	---	74
13	RdR, fall TP	HP	---	76	82	70	49	---	---	22	---
14		GP	---	77	83	71	50	---	27	23	---
15		FP	---	78	85	72	51	35	27	---	---
16		LP	---	79	86	73	52	35	---	---	---
17	Wheeltrack pl, RdL, TP 8/	4,500	---	---	31	27	25	---	---	18	23
18		3,400	---	---	36	32	30	---	22	18	30
19		2,600	---	---	43	36	32	29	23	19	37
20		2,000	---	---	51	43	36	31	24	20	47
21	Deep off-set disk or	4,500	10	---	45	38	34	---	---	20	23
22	disk plow	3,400	10	---	52	43	37	---	24	20	30
23		2,600	5	---	57	48	40	32	25	21	37
24		2,000	---	---	61	51	42	33	26	22	47
25	No-till plant in crop	6,000	95	---	2	2	2	---	---	2	14
26	residue 9/	6,000	90	---	3	3	3	---	---	3	14
27		4,500	80	---	5	5	5	---	---	5	15
28		3,400	70	---	8	8	8	---	8	6	19
29		3,400	60	---	12	12	12	12	9	8	23
30		3,400	50	---	15	15	14	14	11	9	27
31		2,600	40	---	21	20	18	17	13	11	30
32		2,600	30	---	26	24	22	21	17	14	36
	Chisel, shallow disk, or fld cult, as only tillage:										
33	On moderate slopes	6,000	70	---	8	8	7	---	---	7	17
34			60	---	10	9	8	---	---	8	17
35			50	---	13	11	10	---	---	9	18
36			40	---	15	13	11	---	---	10	19
37			30	---	18	15	13	---	---	12	20
38			20	---	23	20	18	---	---	16	21

Table B-7, continued.

Line No.	Cover, crop sequence, and management 1/	Spring residue 2/	Cover after plant 3/	Soil loss ratio 4/ for cropstage period and canopy cover 5/ F	SB	1	2	3:80	90	96	4L 6/
		Lb	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
39	On moderate slopes	4,500	70	---	9	8	7	---	---	7	18
40			60	---	12	10	9	---	---	8	18
41			50	---	14	13	11	---	---	9	19
42			40	---	17	15	13	---	---	10	20
43			30	---	21	18	15	---	---	13	21
44			20	---	25	22	19	---	---	16	22
45	Do.	3,400	60	---	13	11	10	---	10	8	20
46			50	---	16	13	12	---	12	9	24
47			40	---	19	17	16	---	14	11	25
48			30	---	23	21	19	---	17	14	26
49			20	---	29	25	23	---	21	16	27
50			10	---	36	32	29	---	24	20	30
51	Do.	2,600	50	---	17	16	15	15	13	10	29
52			40	---	21	20	19	19	15	12	30
53			30	---	25	23	22	22	18	14	32
54			20	---	32	29	28	27	22	17	34
55			10	---	41	36	34	32	25	21	37
56	Do.	2,000	40	---	23	21	20	20	15	12	37
57			30	---	27	25	24	23	19	15	39
58			20	---	35	32	30	28	22	18	42
59			10	---	46	42	38	33	26	22	47
	On slopes >12 percent.										
60	Lines 33-59 times factor of:		---	---	1.3	1.3	1.1	1.0	1.0	1.0	1.0
	Disk or harrow after spring chisel or fld cult:										
	Lines 33-59 times factor of:										
61	On moderate slopes	---	---	---	1.1	1.1	1.1	1.0	1.0	1.0	1.0
62	On slopes >12 percent	---	---	---	1.4	1.4	1.2	1.0	1.0	1.0	1.0
	Ridge plant: 10/										
	Lines 33-59 times factor of:										
63	Rows on contour 11/	---	---	---	.7	.7	.7	.7	.7	.7	.7
64	Rows U/D Slope <12%	---	---	---	.7	.7	1.0	1.0	1.0	1.0	1.0
65	Rows U/D slope >12%	---	---	---	.9	.9	1.0	1.0	1.0	1.0	1.0
	Till plant:										
	Lines 33-59 times factor of:										
66	Rows on contour 11/	---	---	---	.7	.85	1.0	1.0	1.0	1.0	1.0
67	Rows U/D slope <7%	---	---	---	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Strip till one-fourth of row spacing:										
68	Rows on contour 11/	4,500	60 12/	---	12	10	9	---	---	8	23
69		3,400	50	---	16	14	12	---	11	10	27
70		2,600	40	---	22	19	17	17	14	12	30
71		2,000	30	---	27	23	21	20	16	13	36

Table B-7, continued.

Line No.	Cover, crop sequence, and management 1/	Spring residue 2/	Cover after plant 3/	Soil loss ratio 4/ for cropstage period and canopy cover 5/ F	SB	1	2	3:80	90	96	4L 6/
		Lb	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
72	Rows U/D slope	4,500	60 12/	---	16	13	11	---	---	9	23
73		3,400	50	---	20	17	14	---	12	11	27
74		2,600	40	---	26	22	19	17	14	12	30
75		2,000	30	---	31	26	23	20	16	13	36
	Vari-till:										
76	Rows on contour 11/	3,400	40	---	13	12	11	---	---	11	22
77		3,400	30	---	16	15	14	14	13	12	26
78		2,600	20	---	21	19	19	19	16	14	34
	CORN AFTER WC OF RYEGRASS OR WHEAT SEEDED IN C STUBBLE										
	WC reaches stemming stage:										
79	No-till pl in killed WC	4,000	---	---	7	7	7	---	7	6	13/
80		3,000	---	---	11	11	11	11	9	7	
81		2,000	---	---	15	15	14	14	11	9	
82		1,500	---	---	20	19	18	18	14	11	
	Strip till one-fourth space										
83	Rows U/D slope	4,000	---	---	13	12	11	---	11	9	13/
84		3,000	---	---	18	17	16	16	13	10	
85		2,000	---	---	23	22	20	19	15	12	
86		1,500	---	---	28	26	24	22	17	14	
87	Rows on contour 11/	4,000	---	---	10	10	10	---	10	8	13/
88		3,000	---	---	15	15	15	15	12	9	
89		2,000	---	---	20	20	19	19	15	12	
90		1,500	---	---	25	24	23	22	17	14	
91	Tp, conv seedbed	4,000	---	36	60	52	41	---	24	20	13/
92		3,000	---	43	64	56	43	31	25	21	
93		2,000	---	51	68	50	45	33	26	22	
94		1,500	---	61	73	64	47	35	27	23	
	WC succulent blades only:										
	No-till pl in killed WC	3,000	---	---	11	11	17	23	18	16	13/
96		2,000	---	---	15	15	20	25	20	17	
97		1,500	---	---	20	20	23	26	21	18	
98		1,000	---	---	26	26	27	27	22	19	
99	Strip till one-fourth	3,000	---	---	18	18	21	25	20	17	13/
100	row space	2,000	---	---	23	23	25	27	21	18	
101		1,500	---	---	28	28	28	28	22	19	
102		1,000	---	---	33	33	31	29	23	20	
	CORN IN SODBASED SYSTEMS										
	No-till pl in killed sod:										
103	3 to 5 tons hay yld	---	---	---	1	1	1	---	1	1	1
104	1 to 2 tons hay yld	---	---	---	2	2	2	2	2	2	2
	Strip till, 3-5 ton M:										
105	50% cover, tilled strips	---	---	---	2	2	2	---	2	2	4
106	20% cover, tilled strips	---	---	---	3	3	3	---	3	3	5

Table B-7, continued.

Line No.	Cover, crop sequence, and management 1/	Spring residue 2/	Cover after plant 3/	Soil loss ratio 4/ for cropstage period and canopy cover 5/							
				F	SB	1	2	3:80	90	96	4L 6/
		Lb	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
	Strip till, 1-2 ton M:										
107	40% cover, tilled strips	---	---	---	4	4	4	4	4	4	6
108	20% cover, tilled strips	---	---	---	5	5	5	5	5	5	7
	Other tillage after sod:			14/	14/	14/	14/	14/	14/	14/	14/
	CORN AFTER SOYBEANS										
109	Sprg TP, conv till	HP	---	40	72	60	48	---	---	25	29
110		GP	---	47	78	65	51	---	30	25	37
111		FP	---	56	83	70	54	40	31	26	44
112	Fall TP, conv till	HP	---	47	75	60	48	---	---	25	---
113		GP	---	53	81	65	51	---	30	25	---
114		FP	---	62	86	70	54	40	31	26	---
115	Fall & sprg chisel or cult	HP	30 15/	---	40	35	29	---	---	23	29
116		GP	25	---	45	39	33	---	27	23	37
117		GP	20	---	51	44	39	34	27	23	37
118		FP	15	---	58	51	44	36	28	23	44
119		LP	10	---	67	59	48	36	28	23	54
120	No-till pl in crop res'd	HP	40 15/	---	25	20	19	---	14	11	26
121		GP	30	---	33	29	25	22	18	14	33
122		FP	20	---	44	38	32	27	23	18	40
	BEANS AFTER CORN										
123	Sprg TP, RdL, conv till	HP	---	33	60	52	38	---	20	17	16/
124		GP	---	39	64	56	41	---	21	18	
125		FP	---	45	68	60	43	29	22	---	
126	Fall TP, RdL, conv till	HP	---	45	69	57	38	---	20	17	16/
127		GP	---	52	73	61	41	---	21	18	
128		FP	---	59	77	65	43	29	22	---	
	Chisel or fld cult:			17/	17/	17/	17/	17/	17/	17/	16/
	BEANS AFTER BEANS			18/	18/	18/	18/	18/	18/	18/	16/
	GRAIN AFTER C, G, GS, COT 19/										
129	In disked residues:	4,500	70	---	12	12	11	7	4	2	20/
130		3,400	60	---	16	14	12	7	4	2	
131			50	---	22	18	14	8	5	3	
132			40	---	27	21	16	9	5	3	
133			30	---	32	35	18	9	6	3	
134			20	---	38	30	21	10	6	3	
135	Do.	2,600	40	---	29	24	19	9	6	3	20/
136			20	---	43	34	24	11	7	4	
137			10	---	52	39	27	12	7	4	
138	Do.	2,000	30	---	38	30	23	11	7	4	20/
139			20	---	46	36	26	12	7	4	
140			10	---	56	43	30	13	8	5	
141	In disked stubble, RdR	---	---	---	79	62	42	17	11	6	20/

Table B-7, continued.

Line No.	Cover, crop sequence, and management 1/	Spring residue 2/	Cover after plant 3/	Soil loss ratio 4/ for cropstage period and canopy cover 5/ F	SB	1	2	3:80	90	96	4L 6/
		Lb	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
142	Winter G after fall TP, RDL	HP	---	31	55	48	31	12	7	5	20/
143		GP	---	36	60	52	33	13	8	5	
144		FP	---	43	64	56	36	14	9	5	
145		LP	---	53	68	60	38	15	10	6	
	GRAIN AFTER SUMMER FALLOW										
146	With grain residues	200	10	---	70	55	43	18	13	11	21/
147		500	30	---	43	34	23	13	10	8	
148		750	40	---	34	27	18	10	7	7	
149		1,000	50	---	26	21	15	8	7	6	
150		1,500	60	---	20	16	12	7	5	5	
151		2,000	70	---	14	11	9	7	5	5	
152	With row crop residues	300	5	---	82	65	44	19	14	12	21/
153		500	15	---	62	49	35	17	13	11	
154		750	23	---	50	40	29	14	11	9	
155		1,000	30	---	40	31	24	13	10	8	
156		1,500	45	---	31	24	18	10	8	7	
157		2,000	55	---	23	19	14	8	7	5	
158		2,500	65	---	17	14	12	7	5	4	
	POTATOES										
159	Rows with slope	---	---	43	64	56	36	26	19	16	
160	Contoured rows, ridged when canopy cover is about 10 percent 11/	---	---	43	64	28	18	13	10	8	

1/ Data adapted from CRR 26 (p. 233-235) and originally published in Agriculture Handbook 537 (p. 22-24). This table includes corrections in line 160 and footnote 13 made after publication of Handbook 537.

Cover, crop sequence, and management symbols: B, soybeans; C, corn; conv till, plow, dis and harrow for seedbed; cot, cotton; F, rough fallow, fld cult, field cultivator; G, smal grain; GS, grain sorghum; M, grass and legume meadow, at least 1 full year; pl, plant; RdL, crop residues left on field; RdR, crop residues removed; SB, seedbed period; sprg, spring; TP, plowed with moldboard; WC, winter cover crop;---, insignificant or an unlikel combination of variables.

2/ Dry weight per acre after winter loss and reductions by grazing or partial removal; 4,500 lbs represents 100 to 125 bu corn; 3,400 lbs, 75 to 99 bu; 2,600 lbs, 60 to 74 bu; and 2,000 lbs, 40 to 59 bu; with normal 30-percent winter loss. For RdR or fall-plow practices, these four productivity levels are indicated by HP, GP, FP, and LP, respectively (high, good, fair, and low productivity). In lines 79 to 102, this column indicates dry weight of the winter-cover crop.

3/ Percentage of soil surface covered by plant residue mulch after crop seeding. The difference between spring residue and that on the surface after crop seeding is reflected in the soil loss ratios as residues mixed with the topsoil.

Table B-7, continued.

4/ The soil loss ratios, given as percentages, assume that the indicated crop sequence and practices are followed consistently. One-year deviations from normal practices do not have the effect of a permanent change. Linear interpolation between lines is recommended when justified by field conditions. See also footnote 7.

5/ Cropstage periods are as defined on p. 18, Agriculture Handbook 537. The three columns for cropstage 3 are for 80, 90, and 96 to 100 percent canopy cover at maturity.

6/ Column 4L is for all residues left on field. Corn stalks partially standing as left by some mechanical pickers. If stalks are shredded and spread by picker, select ratio from table B-10. When residues are reduced by grazing, take ratio from lower spring-residue line.

7/ Period 4 values in lines 9 to 12 are for corn stubble (stover removed).

8/ Inversion plowed, no secondary tillage. For this practice, residues must be left and incorporated.

9/ Soil surface and chopped residues of matured preceding crop undisturbed except in narrow slots in which seeds are planted.

10/ Top of old row ridge sliced off, throwing residues and some soil into furrow areas. Reridging assumed to occur near end of cropstage 1.

11/ Where lower soil loss ratios are listed for rows on the contour, this reduction is in addition to the standard field contouring credit. The P value for contouring is used with these reduced loss ratios.

12/ Field-average percent cover; probably about three-fourths of percent cover on undisturbed strips.

13/ Divide the winter cover period into cropstages for the seeded cover and use lines 132-145.

14/ Select the appropriate line for the crop, tillage, and productivity level and multiply the listed soil loss ratios by sod residual factors from table B-11.

15/ Spring residue may include carryover from prior corn crop.

16/ See table B-10.

17/ Use values from lines 33 to 62 with appropriate dates and lengths of cropstage periods for beans in the locality.

18/ Values in lines 109 to 122 are best available estimates, but planting dates and lengths of cropstages may differ.

19/ When meadow is seeded with the grain, its effect will be reflected through higher percentages of cover in cropstages 3 and 4.

20/ Ratio depends on percent cover. See table B-10.

21/ See "SUMMER FALLOW" item in table B-9.

Table B-8.--Approximate soil loss ratios for cotton 1/

Practice number	Tillage operation(s)			
	Expected final canopy percent cover:	65	80	95
	Estimated initial percent cover from defoliation + stalks down:	30	45	60
		Soil loss ratio 2/		
	COTTON ANNUALLY:		Percent	
1 . . .	None:			
	Defoliation to December 31	36	24	15
	January 1 to February or March tillage:			
	Cot Rd only	52	41	32
	Rd & 20 percent cover vol veg. 3/	32	26	20
	Rd & 30 percent cover vol veg.	26	20	14
2 . . .	Chisel plow soon after cot harvest:			
	Chiseling to December 31	40	31	24
	January 1 to sprg tillage	56	47	40
3 . . .	Fall disk after chisel:			
	Disking to December 31	53	45	37
	January 1 to sprg tillage	62	54	47
4 . . .	Chisel plow February-March, no prior tillage:			
	Cot Rd only	50	42	35
	Rd & 20 percent vol veg	39	33	28
	Rd & 30 percent vol veg	34	29	25
5 . . .	Bed ("hip") Feb-Mar, no prior tillage:			
	Cot Rd only	100	84	70
	Rd & 20 percent vol veg	78	66	56
	Rd & 30 percent vol veg	68	58	50
	Split ridges & plant after hip, or Disk & plant after chisel (SB):			
	Cot Rd only	61	54	47
	Rd & 20 percent vol veg	53	47	41
	Rd & 30 percent vol veg	50	44	38
	Cropstage 1:			
	Cot Rd only	57	50	43
	Rd & 20 percent vol veg	49	43	38
	Rd & 30 percent vol veg	46	41	36
	Cropstage 2:	45	39	34
	Cropstage 3:	40	27	17
6 . . .	Bed (hip) after prior tillage:			
	Cot Rd only	110	96	84
	Rd & 20 percent veg	94	82	72
	Rd & 30 percent veg	90	78	68
	Split ridges after hip (SB):			
	Cot Rd only	66	61	52
	Rd & 20 to 30 percent veg	61	55	49
	Cropstage 1:			
	Cot Rd only	60	56	49
	Rd & 20 to 30 percent veg	56	51	46
	Cropstage 2:	47	44	38
	Cropstage 3:	42	30	19

Table B-8, continued.

Expected final canopy percent cover:	65	80	95
Estimated initial percent cover from defoliation + stalks down:	30	45	60
Practice number — Tillage operation(s)	Soil loss ratio 2/		
7 . . . Hip after 2 prior tillages:			
Cot Rd only	116	108	98
Rd & 20-30 percent veg	108	98	88
Split ridges after hip (SB)	67	62	57
8 . . . Hip after 3 or more tillages:	120	110	102
Split ridges after hip (SB)	68	64	59
9 . . . Conventional moldboard plow and disk:			
Fallow period	42	39	36
Seedbed period	68	64	59
Cropstage 1	63	59	55
Cropstage 2	49	46	43
Cropstage 3	44	32	22
Cropstage 4 (See practices 1, 2, and 3)			

COTTON AFTER SOD CROP:
For the first or second crop after a grass or grass-and-legume meadow has been turnplowed, multiply values given in the last five lines above by sod residual factors from table B-11.

COTTON AFTER SOYBEANS:
Select values from above and multiply by 1.25.

OTHER:
See table B-9.

1/ Data in table adapted from CRR 26 (p. 236) and originally published in Agriculture Handbook 537 (p. 25).

2/ Alternate procedure for estimating the soil loss ratios:

The ratios given above for cotton are based on estimates for reductions in percent cover through normal winter loss and by the successive tillage operations. Research is underway in Mississippi to obtain more accurate residue data in relation to tillage practices.

Where the reductions in percent cover by winter loss and tillage operations are small, use figure B-1 to compute soil loss ratios for the preplant and seedbed periods. In the figure, find the percentage of the field surface covered by residue mulch, move vertically to the upper curve, and read the mulch factor on the scale at the left. Multiply this factor by a factor selected from

Table B-8, continued.

the following tabulation to credit for effects of land-use residual, surface roughness, and porosity.

Productivity level	No tillage	Rough surface	Smoothed surface
High	0.66	0.50	0.56
Medium	.71	.54	.61
Poor	.75	.58	.65

Values for the bedded period on slopes of less than 1 percent should be estimated at twice the value computed above for rough surfaces.

3/ Rd, crop residue; vol veg, volunteer vegetation.

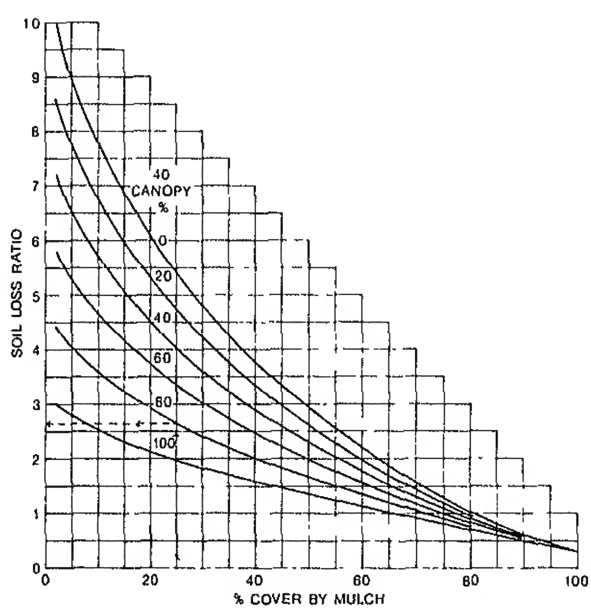


Figure B-1.--Combined mulch and canopy effects when average fall distance of drops from canopy to ground is about 40 inches.

Table B-9.--Soil loss ratios for conditions not evaluated in table B-7

COTTON:

See table B-8.

CROPSTAGE 4 FOR ROWCROPS:

Stalks broken and partially standing: Use col. 4L.

Stalks standing after hand picking: Col. 4L times 1.15.

Stalks shredded without soil tillage: See table B-10.

Fall chisel: Select values from lines 33-62, seedbed column.

CROPSTAGE 4 FOR SMALL GRAIN:

See table B-10.

DOUBLE CROPPING:

Derive annual C value by selecting from table B-7 the soil loss percentage for the successive cropstage periods of each crop.

ESTABLISHED MEADOW, FULL-YEAR PERCENTAGES:

Grass and legume mix, 3 to 5 t. hay	0.4
Do. 2 to 3 t. hay	.6
Do. 1 t hay	1.0
Sericea, after second year	1.0
Red clover	1.5
Alfalfa, lespedeza, and second-year sericea	2.0
Sweetclover	2.5

MEADOW SEEDING WITHOUT NURSE CROP:

Determine appropriate lengths of cropstage periods SB, 1, and 2, and apply values given for small grain seeding.

PEANUTS:

Comparison with soybeans is suggested.

PINEAPPLES:

Direct data not available. Tentative values derived analytically are available from the SCS in Hawaii or the West National Technical Center at Portland, Oregon.

SORGHUM:

Select values given for corn, on the basis of expected crop residues and canopy cover.

SUGARBEETS:

Direct data not available. Probably most nearly comparable to potatoes, without the ridging credit.

SUGARCANE:

Tentative values available from sources given for pineapples.

SUMMER FALLOW IN LOW-RAINFALL AREAS, USE GRAIN OR ROW CROP RESIDUES:

The approximate soil loss percentage after each successive tillage operation may be obtained from the tabulation by estimating the percent surface cover after that tillage and selecting the column for the appropriate amount of initial residue. The given values credit benefits of the residue mulch, residues mixed with soil by tillage, and the crop system residual. Use the

Table B-9, continued.

following tabulation for summer fallow in low-rainfall areas:

Percent cover by mulch	Initial residue (lb/ac) 4,000	3,000	2,000	1,500
90	4	---	---	---
80	8	8 2/	---	---
70	12	13	14 2/	---
60	16	17	18 2/	19 2/
50	20	22	24	25 2/
40	25	27	30	32
30	29	33	37	39
20	35	39	44	48
10	47	55	63	68

WINTER COVER SEEDING IN ROW CROP STUBBLE OR RESIDUES:

Define cropstage periods based on the cover seeding date and apply values from lines 129 to 145.

1/ Data from CRR 26 (p. 237) and originally published in Agric. Handb. 537 (p. 26).

2/ For grain residue only.

Table B-10.--Soil loss ratios (pct) for cropstage 4 when stalks are chopped and distributed without soil tillage 1/

Mulch cover 2/	Corn or sorghum: Tilled seedbed 3/	Corn or sorghum: No-till	Soybeans: Tilled seedbed 3/	Soybeans: No-till in corn rd 4/	Grain stubble 5/
20	48	34	60	42	48
30	37	26	46	32	37
40	30	21	38	26	30
50	22	15	28	19	22
60	17	12	21	16	17
70	12	8	15	10	12
80	7	5	9	6	7
90	4	3	--	--	4
95	3	2	--	--	3

1/ Data from CRR 26 (p. 237); originally from Agric. Handb. 537.

2/ Part of a field surface directly covered by pieces of residue mulch.

3/ All systems other than no-till.

4/ Cover after bean harvest may include an appreciable number of stalks carried over from the prior corn crop.

5/ For grain with meadow seeding, include meadow growth in percent cover and limit grain period 4 to 2 mo. Thereafter, classify as established meadow.

Table B-11.--Factors to credit residual effects of turned sod 1/

Crop	Hay yield	Factor for cropstage period: 2/				
		F	SB and 1	2	3	4
	Tons					
First year after mead:						
Row crop or grain . .	3-5	0.25	0.40	0.45	0.50	0.60
	2-3	.30	.45	.50	.55	.65
	1-2	.35	.50	.55	.60	.70
Second year after mead:						
Row crop	3-5	.70	.80	.85	.90	.95
	2-3	.75	.85	.90	.95	1.0
	1-2	.80	.90	.95	1.0	1.0
Spring grain	3-5	---	.75	.80	.85	.95
	2-3	---	.80	.85	.90	1.0
	1-2	---	.85	.90	.95	1.0
Winter grain	3-5	---	.60	.70	.85	.95
	2-3	---	.65	.75	.90	1.0

1/ Data from CRR 26 (p. 237); originally published in Agriculture Handbook 537 (p. 26).

2/ These factors are to be multipled by the appropriate soil loss percentages selected from table B-7. They are directly applicable for sod-forming meadows of at least 1 full year duration, plowed not more than 1 month before final seedbed preparation.

When sod is fall plowed for spring planting, the listed values for all cropstage periods are increased by adding 0.02 for each additional month by which the plowing precedes spring seedbed preparation. For example, September plowing would precede May disking by 8 months, so 0.14 would be added to each value in the table [0.02 x (8 - 1) = 0.14]. For nonsod-forming meadows, like sweetclover or lespedeza, multiply the factors by 1.2. When the computed value is greater than 1.0, use 1.0.

Table B-12.--Contour factor values (PFACT) and slope-length limits for contouring 1/

Land slope	Contour factor value (PFACT) 2/	Maximum length 3/
(%)		(ft)
1 to 2 -------------------	0.60	400
3 to 5 -------------------	.50	300
6 to 8 -------------------	.50	200
9 to 12 -------------------	.60	120
13 to 16 -------------------	.70	80
17 to 20 -------------------	.80	60
21 to 25 -------------------	.90	50

1/ From CRR 26 (p. 239); originally published in Agriculture Handbook 537 (p. 35).

2/ Use figure B-2 to adjust nonlinearly the contouring factor where rows are neither on the contour nor directly uphill and downhill. This adjusted factor also should be weighted for the watershed area.

3/ Limit may be increased by 25% if residue cover after crop seeding regularly will exceed 50%.

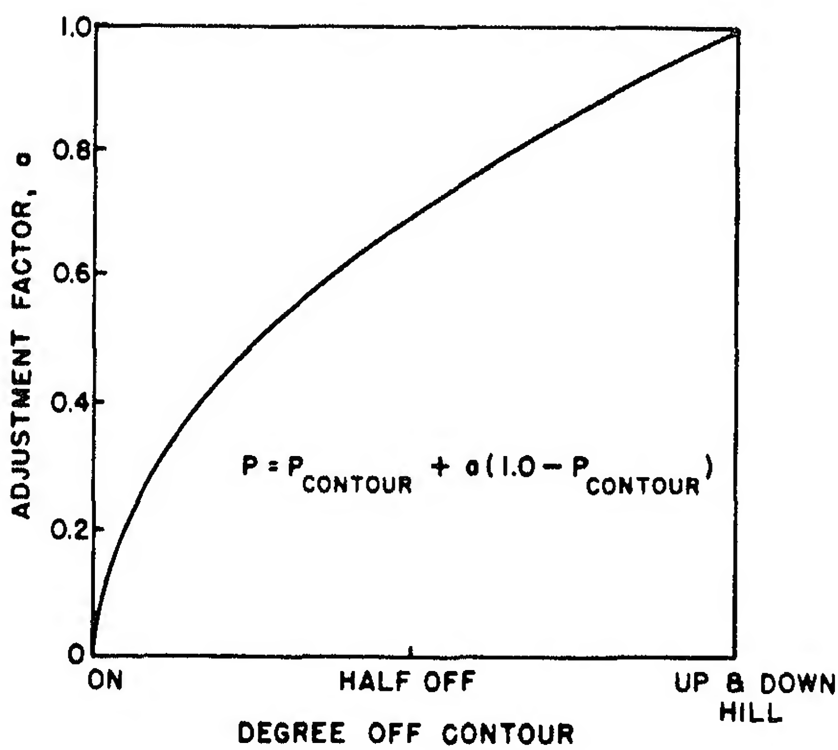


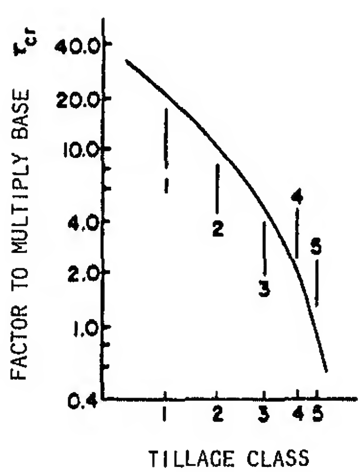
Figure B-2.--Adjustment factor for being off contour with tillage (from CRR 26, p. 240).

Table B-13.--Critical shear stress as a function of tillage and consolidation for moderately erodible soils 1/

Tillage-consolidation condition	Critical shear stress (CCHAN)
	(lb/ft^2)
Moldboard plowed	0.20
Chisel or disk for primary tillage	.15
Disking for common seedbed for corn or cultivation of crop	.10
Finely pulverized seedbed	.05
1 month after last tillage of common seedbed	.20
2 months after last tillage of common seedbed	.30
3 months after last tillage of common seedbed	.40
Long-term, undisturbed	.60

1/ From CRR 26, p. 249.

2/ The base critical shear stress is equivalent to a finely pulverized seedbed. Use 0.05 lb/ft^2 unless a better dispersion ratio is available from local data. To obtain an estimate of apparent critical shear stress, select a factor from figure B-3 and multiply it by the base critical shear stress.



TILLAGE CLASSES FOR TYPICAL MIDWESTERN SILT LOAM SOIL

1. Long-term without tillage
2. One year since seedbed tillage
3. Primary tillage in land one year since seedbed tillage
4. Typical seedbed
5. Finely pulverized seedbed

Adjust down for soils whose particles do not tend to bond together (e.g. sands).

For soils with 25-30% clay, increase the factor by 1.5; for 30-45% clay, double the factor; for soils with greater than 60% sand, multiply the factor by 0.6.

Figure B-3.--Effect of tillage on base critical shear stress.

Table B-14.--Changes along a channel: A sample data set at seedbed time 1/

Parameter	Tilled portion		Grassed waterway	
	Distance from end	Parameter value	Distance from end	Parameter value
Manning's n (NCHAN)--------------	900.0	0.03	1000.0	0.13
Critical soil shear (CCHAN)------	900.0	.10	1000.0	.60
Depth to nonerodible (DCHAN)-----	900.0	.33	Same for entire	
Depth at side of channel (SCHAN)-	900.0	.33	channel length	
Channel width (WCHAN)------------	900.0	20.00		

1/ Adapted from CRR 26, p. 246-247. The model can describe changes in all parameters along the channel, but it primarily represents the end or beginning of grass within the length of the channel. Figure B-4 shows a typical grassed waterway ending within a field. Where the channel flattens, erosion in the waterway probably would not occur. The channel from 900 to 1000 ft would be tilled.

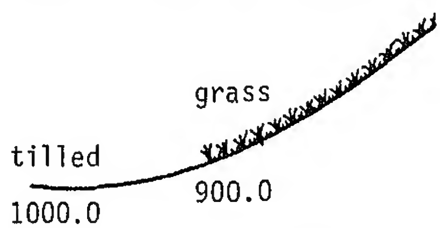


Figure B-4.--Representation of a channel having a change in cover along it.

Table B-15.--Guidelines on using the built-in friction slope curves

Condition	Friction slope assumption
Supercritical flow all along the channel and at the outlet.	Kinematic (normal) flow. FLAGS = 2
Small discharge; very flat channel gradient (0.001 to 0.005); critical depth at outlet (for example, channel flow in a row middle).	Kinematic (normal) flow. FLAGS = 2
Restricted outlet giving backwater.	Friction slope curves. FLAGS = 1
Critical depth at the outlet of diversions and conventional terrace channels.	Friction slope curves. FLAGS = 1
Zero grade channel (for example, level terraces).	Friction slope curves. FLAGS = 1

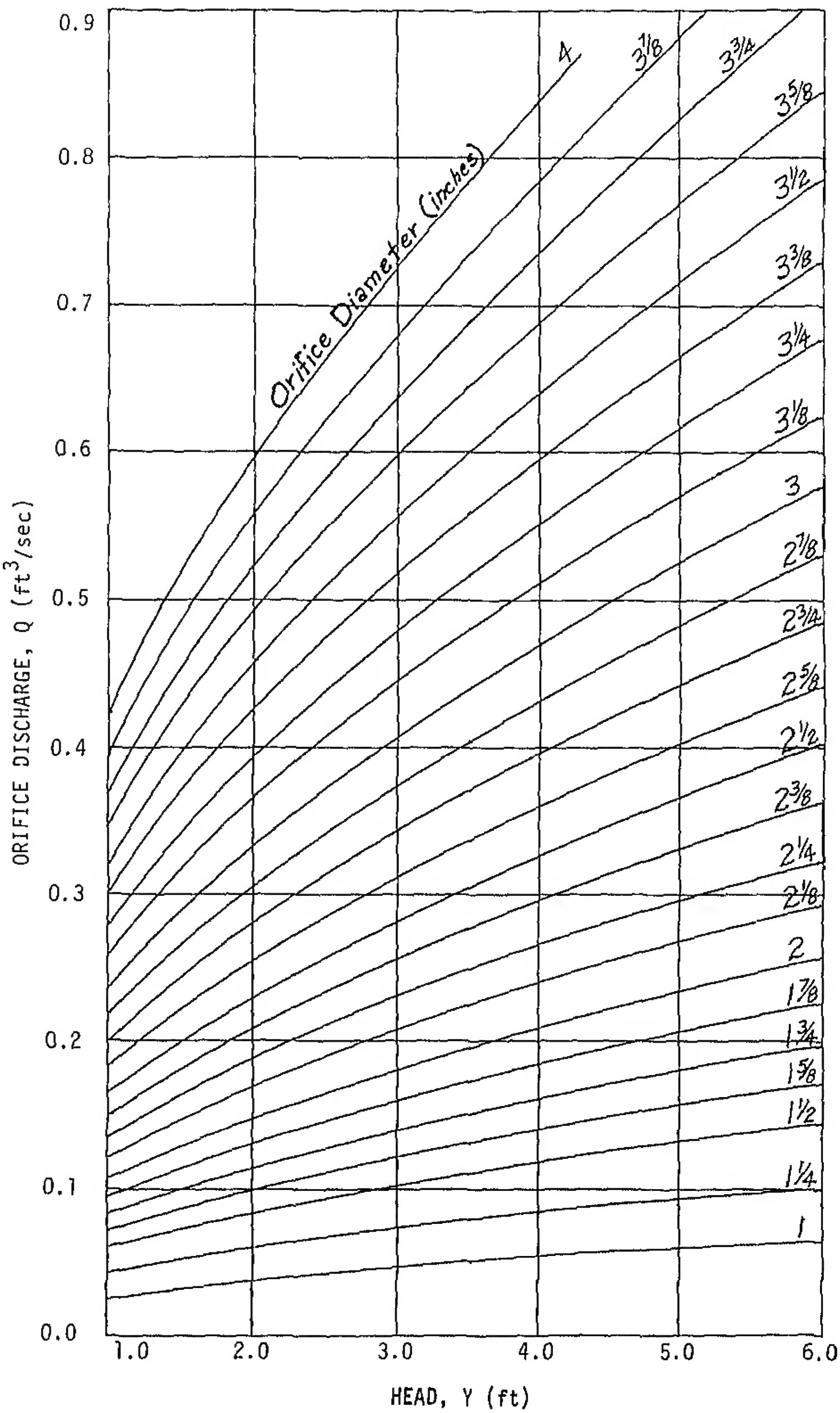


Figure B-5.--Relationship of orifice discharge to head for various orifice diameters. Also see figure B-6.

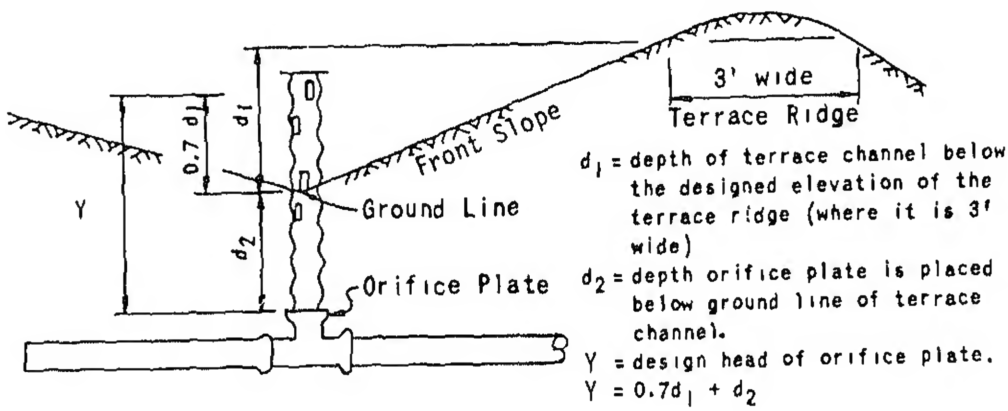


Figure B-6.--Typical pipe outlet terrace, cross section.

APPENDIX C

NUTRIENT PARAMETER TABLES

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Table C-1.--Approximate yield and nutrient content of selected crops 1/

Crop		Yield (kg/ha)	Yield (units/acre)	Nitrogen (N) (kg/ha)	Nitrogen (N) (lb/acre)	Phosphorus (P) 2/ (kg/ha)	Phosphorus (P) 2/ (lb/acre)
Alfalfa 3/		8,960	(4 tons)	224	(200)	20	(18)
Barley	grain	2,150	(40 bu)	39	(35)	7	(6)
	straw	2,240	(1 ton)	17	(15)	2	(2)
Beans 3/	(dry)	1,950	(30 bu)	84	(75)	11	(10)
Bermudagrass		17,920	(8 tons)	224	(200)	34	(30)
Bluegrass		4,480	(2 tons)	67	(60)	9	(8)
Cabbage		44,800	(20 tons)	168	(150)	18	(16)
Clover 3/	red	4,480	(2 tons)	90	(80)	11	(10)
	white	4,480	(2 tons)	146	(130)	11	(10)
Corn	grain	9,400	(150 bu)	151	(135)	27	(24)
	stover	10,080	(4.5 tons)	112	(100)	18	(16)
	silage	56,000	(25 tons)	224	(200)	34	(30)
Cotton	lint & seed	2,240	(1 ton)	67	(60)	13	(12)
	stalks	2,240	(1 ton)	50	(45)	7	(6)
Cowpea hay 3/		4,480	(2 tons)	134	(120)	11	(10)
Lettuce		44,800	(20 tons)	100	(90)	13	(12)
Lespedeza 3/		4,480	(2 tons)	95	(85)	9	(8)
Oats	grain	3,200	(90 bu)	62	(55)	11	(10)
	straw	4,480	(2 tons)	28	(25)	9	(8)
Onions		16,800	(7.5 tons)	50	(45)	9	(8)
Oranges		62,720	(28 tons)	95	(85)	13	(12)
Peanuts 3/	nuts	3,360	(1.5 tons)	123	(110)	7	(6)
Potatoes	tubers	44,800	(400 cwt)	106	(95)	13	(12)
	vines	2,240	(1 ton)	100	(90)	9	(8)
Rice	grain	4,540	(90 bu)	62	(55)	13	(12)
	straw	5,600	(2.5 tons)	34	(30)	4	(4)
Rye	grain	1,880	(30 bu)	39	(35)	4	(4)
	straw	3,360	(1.5 tons)	17	(15)	4	(4)
Sorghum	grain	3,360	(60 bu)	56	(50)	11	(10)
	stover	6,720	(3 tons)	73	(65)	9	(8)
Soybeans 3/	grain	3,020	(45 bu)	179	(160)	18	(16)
	straw	2,240	(1 ton)	28	(25)	4	(4)
Sugarbeets	roots	44,800	(20 tons)	95	(85)	16	(14)
	tops	26,880	(12 tons)	123	(110)	11	(10)
Sugarcane	stalks	67,200	(30 tons)	112	(100)	22	(20)
	tops	29,120	(13 tons)	56	(50)	11	(10)
Timothy		5,600	(2.5 tons)	67	(60)	11	(10)
Tobacco		3,360	(1.5 tons)	129	(115)	11	(10)
Tomatoes	fruit	56,000	(25 tons)	162	(145)	22	(20)
	vines	3,360	(1.5 tons)	78	(70)	11	(10)
Wheat	grain	3,360	(50 bu)	73	(65)	16	(14)
	straw	3,360	(1.5 tons)	22	(20)	2	(2)

1/ From CRR 26, p. 73. Values can vary by a factor of two across the country and can be adjusted to local yields.

2/ Pounds of P = 0.436 times pounds of P_2O_5.

3/ Legumes that do not require fertilizer nitrogen.

Table C-2.--Potential mineralizable nitrogen 1/

Soil order	Soils	N_o (POTM, card 11)
	(number)	(kg/ha)
Alfisol------	10	391±167
Aridisol-----	7	289±207
Entisol------	7	342±176
Inceptisol---	1	245
Mollisol-----	22	444±195
Spodosol-----	2	600±109
Ultisol------	12	262±142
Vertisol-----	1	389
All above----	62	373±189

1/ Adapted from CRR 26, p. 494.

Table C-3.--N uptake parameters for option 2 1/

Crop	Potential N uptake (PU)	50% uptake (DOM)	84% uptake (SD)
	(kg/ha)	(days)	(days)
Corn 2/	150 - 300	60	27
Sorghum	140 - 280	70	15
Wheat	90 - 180	50	8
Cotton	60 - 200	60	28
Soybeans	180	60	20
Peanuts	250	65	25
Potatoes	250	60	27

1/ Adapted from CRR 26, p. 503.
2/ Includes corn silage.

APPENDIX D

PESTICIDE PARAMETER TABLES

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Table D-1.--Water solubility (SOLH2O) and application rate (APRATE) of commonly used herbicides 1/

Herbicide trade name	Herbicide common name	Water solubility (ppm)	Application rates 2/ (lb/acre)
Amex 820	A-820	1.0	1 - 5
Lasso	ALACHLOR	242	1 - 4
Evik	AMETRYNE	185	2 - 8
Amitrol-T	AMITROL	280,000	2 - 10
Dessicant	ARSENIC ACID	600,000 (est.)	1.5
AA trex	ATRAZINE	33	2 - 4
Balan	BENEFIN	1	1.12 - 1.5
Basagran	BENTAZON	500	0.5 - 1.5
Hyvar-X	BROMACIL	815	1.5 - 24
Machete	BUTACHLOR	23	1.5 - 4
Sutan	BUTYLATE	45	3 - 4
Bromex	CHLORBROMURON	50	0.25 - 4
Norex	CHLOROXURON	2.7	2 - 8
2,4-D	2,4-D	900	0.25 - 4
Dowpon	DALAPON	600,000 (est.)	0.75 - 20
Banvel	DICAMBA	4,500	0.06 - 10
Cobsx	DINITRAMINE	1	1/3 - 2/3
Dymid, Enide	DEPHENAMID	260	2 - 6
Karmex	DIURON	42	0.06 - 48
Urab	FENURON	3,850	18 - 27
Cotoran	FLUOMETURON	90	0.5 - 4
Roundup	GLYPHOSATE	12,000	1 - 4
PAARLAN	ISOPROPALIN	0.11	1 - 2
Sencor, Lexone	METRIBUZIN	1,220	0.25 - 1.0
Cadonate, Weed-Hoe	MSMA	570,000 (est.)	2 - 3.8
Telvar	MONURON	230	- 4 - 48
Planavin	NITRALIN	0.6	0.5 - 1.5
Ryzelan	ORYZALIN	2.4	0.75 - 1.75
Ortho Paraquat	PARAQUAT	500,000 (est.)	0.25 - 1
Tordan	PICLORAM	430	1 - 8
Tolban	PROFLURALIN	0.1	0.5 - 1.5
Pramitol	PROMETONE	750	10 - 60
Caparol	PROMETRYNE	48	0.48 - 2.75
Ramrod	PROPACHLOR	580	3 - 6
Milogard	PROPAZINE	8.6	1 - 4
Pyramin	PYRAZON	400	2 - 4
2,4,5-TP	SILVEX	140	0.75 - 16
Princep	SIMAZINE	5	2 - 4
2,4,5-T	2,4,5-T	238	0.5 - 16
Randox	TCBE	2	2.6
Treflan	TRIFLURALIN	1	0.5 - 2
Avidex	DIALLATE	14 (est.)	
Bladex	CYANAZINE	171 (est.)	
Sinox	DINITRO	130 (est.)	

1/ Data adapted from CRR 26, p. 311, and based on H. L. Hilton, R. W. Bovey, H. M. Hull, W. R. Mullison, and R. E. Talbert, 1974, Herbicide Handbook of the Weed Science Society of America, Third edition, Champaign, Illinois, 430 pages.

2/ Range for active ingredient.

Table D-2.--Water solubility (SOLH2O) of commonly used insecticides 1/

Insecticide trade name	Insecticide common name	Water solubility
		(ppm)
Orthene	ACEPHATE	650,000
Guthion	AZINPHOSMETHYL	29
Bux	BUNFENCARB	1 (est.)
Sevin	CARBARYL	40
Furadan	CARBOFURAN	700
Lorsban	CHLORPYRIFOS	2
Spectracide, Diazinon	DIAZINON	40
Di-Syston	DISULFOTON	25
Dasanit	FENSULFOTHION	1,600
Cythion	MALATHION	145
Supracide	METHIDATHION	240
Lannate, Nudrin	METHOMYL	58,000
Metacide	METHYL PARATHION	50 - 60
Niran, Bladan	PARATHION	24
Thimet, Phorate-10G	PHORATE	50
Toxaphene	TOXAPHENE	3

1/ Adapted from CRR 26 (p. 312) and based on G. L. Berg, ed. Farm Chemicals Handbook, Section D, Pesticide Dictionary (1979, Merster Publishing Company, Willoughby, Ohio, 316 pages) and E. W. Lawless, T. L. Ferguson, and A. F. Meiners, Guidelines for the Disposal of Small Quantities of Unused Pesticides (1975, U.S. Environmental Protection Agency Technology Series, EPA-670/2-75-057, 331 pages).

Table D-3.--Pesticide half-lives on foliage 1/

Pesticide	Formulation 2/	Number of observations	Half-life
			(days)
Organochlorine:			
Aldrin	EC	14	4.6± 2.9
	WP	8	4.9± 3.6
	D	1	12.0
Chlordane	EC	2	12.5± 6.4
	WP	11	12.5± 6.4
	D	2	12.5± 6.4
DDT	EC	9	8.4± 3.8
	WP	3	13.9±12.3
	D	4	3.8± 1.3
	EC	2	10.6± 0.5
Dieldrin	EC	6	4.3± 1.4
	WP	5	4.9± 3.3
	D	2	5.8± 0.4
	G	2	17.0± 5.7
Endrin	EC	15	8.0± 4.1
	WP	1	15.0
	D	2	9.0±11.3
Ethylan	EC	1	3.4
Heptachlor	EC	10	5.3± 3.2
	WP	3	2.7± 0.6
	D	10	6.4± 3.9
	G	5	6.3± 4.4
Lindane	EC	5	5.5± 3.3
	WP	4	3.9± 2.4
	D	4	2.1± 0.3
	G	2	7.5± 0.7
Methoxychlor	EC	2	2.5± 0.7
	WP	10	4.9± 2.7
	D	11	3.5± 2.5
	EC	13	6.4± 4.8
	WP	2	2.3± 0.4
	D	5	2.3± 1.2
	EC	6	7.1± 3.7
Organophosphate:			
Acephate	WP	3	2.8± 0.4
Azinphosmethyl	EC	3	1.6± 1.0
	WP	3	7.9± 9.7
	D	3	5.2± 4.5
	EC	5	7.4± 2.4
	WP	1	9.8
	WP	1	16.0
Chlorpyrifos-methyl	EC	1	1.0
	EC	6	3.3± 0.7

Table D-3, continued.

Pesticide	Formulation 2/	Number of observations	Half-life
			(days)
Organophosphate, continued:			
Cyanophenphos	EC	1	2.6
Demeton	EC	20	5.4± 1.9
Diazinon	EC	2	3.0± 2.8
	WP	6	4.0± 3.3
	EC	1	1.1
Dimethoate	EC	5	5.1± 1.7
	WP	1	7.1
Dipterex	EC	1	2.0
EPN	WP	5	5.5± 2.1
Ethion	WP	1	7.5
	EC	10	5.0± 2.7
	WP	1	7.4
Fenitrothion	EC	1	1.5
Leptophos	EC	1	2.2
Malathion	EC	22	2.4± 1.5
	WP	8	4.8± 2.5
	D	13	2.3± 1.4
	EC	1	1.8
Methidathion	EC	1	1.1
Methyl Parathion	EC	2	3.0± 2.8
Parathion	EC	8	2.6± 1.7
	WP	11	4.3± 4.0
	D	2	2.6± 0.6
Phorate	G	1	2.0
Phosalone	EC	1	16.0
Phosdrin	EC	5	0.9± 0.2
Phosphamidon	EC	4	2.0± 1.2
Quinalphos	EC	2	1.6± 0.0
Salithion	EC	1	0.7
Tokuthion	EC	1	3.1
Triazophos	EC	1	3.0
Trithion	WP	1	2.0
	D	2	2.5± 0.7
Carbamate:			
Carbaryl	WP	3	6.8± 1.3
	D	2	1.5± 0.7
Carbofuran	F	1	1.1
Other:			
Permethrin	--	1	35.4
Dicamba	--	1	9.3
2,4-D	--	1	8.9
2,4,5-T	--	1	9.6
Picloram	--	1	8.0

1/ Adapted from CRR 26, p. 509-601. Each line of data represents different study results.

2/ EC - emulsifiable concentrate; WP - wettable powder; D - dust; G - granular; F - flowable.

Table D-4.--Guide to pesticide half-lives on foliage 1/

Class	Group	Mean half-life (days)
Organochlorine	Fast Aldrin (except dust), dieldrin (except dust and granular), ethylan, heptachlor, lindane, methoxychlor.	4.0± 1.0
	Slow Chlordane, DDT, endrin, ethion toxaphene.	9.7± 3.9
Organophosphate	Fast Acephate, chlorpyrifos-methyl, cyano-phenphos, diazinon, dipterex, ethion, fenitrothion, leptophos, malathion, methidathion, methyl parathion, parathion, phorate, phosdrin, phosphamidon, quinalphos, salithion, tokuthion, triazophos, trithion.	2.4± .1
	Slow Azinphosmethyl, demeton, dimethoate, EPN, phosalone.	8.2± 4.6
Carbamate	Fast Carbofuran.	1.1
	Slow Carbaryl WP.	6.8± 1.3

1/ Adapted from CRR 26, p. 601.

Table D-5.--Values of k_s for dissipation of pesticides from soil surfaces 1/ (Adapted from CRR 26, p. 563-564)

Pesticide	Soil: Location or series 1/	Soil: pH	Soil: OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
FUNGICIDES						
Maneb	Keyport sil	---	---	---	---	0.0126
Maneb	Galestown	6.7	5.2	Tomato	2	.0278 2/
Zineb	Galestown	6.7	5.2	Tomato	2	.0512 3/
HERBICIDES						
Asulam	Regina c	7.7	4.2	---	---	.0141-.1174
Benefin	Taloka sl	---	1	---	1.7	.3349
Butralin	Taloka sl	---	1	---	2.24	.1077
2,4-D isooctyl	Galestown	6.7	5.2	Bluegrass	2.8	.0923
2,4-D isooctyl	Acadia sil	5.8	2.6	---	5.7	.0183 3/
2,4-D	Acadia sil	5.8	2.6	---	7.8	.0788
2,4-D isooctyl	Acadia	5.8	2.6	---	15.7	.0486
2,4-D amine	Acadia	5.8	2.6	---	5.6	.0522
2,4-D amine	Acadia	5.8	2.6	---	11.2	.0139
2,4-D amine	Acadia	5.8	2.6	---	22.4	.0108
2,4-D	Acadia	---	---	Arid range	1.03	.1634
2,4-D		---	---	Arid range	---	.1036
2,4-D amine	Acadia	5.8	2.6	---	5.7	.0352
2,4-D isooctyl	Acadia	5.8	2.6	Ester per se	31.4	.2603
Dicamba	Acadia	5.8	2.6	---	1.1-4.3	.0151
Diflubenzuron	Lufkin fsl	---	---	Over winter	---	.0040
Dinitramine	Taloka sl	5.8	2.6	---	.4	.0856
Diuron	New Ya'ar (dry)	---	---	---	4	.136 4/
Diuron	New Ya'ar (wet)	---	---	---	4	.214 4/
Fluchloralin	Taloka sl	---	---	---	.56	.0169
Fluometuron	New Ya'ar (dry)	---	---	---	.56	.043 4/
Fluometuron	New Ya'ar (wet)	---	---	---	.56	.077 4/
Isopropalin	Taloka sil	---	---	---	1.68	.1948
Nitralin	Taloka sil	---	---	---	.56	.1042
Oryzalin	Taloka	---	---	---	.84	.0284
Oxmyl	Keyport sil	---	---	---	6.7	.0646
Oxmyl	Cecil ls	---	---	---	6.7	.0354
Oxmyl	Leon Immokalee fs	---	---	---	6.7	.0448
Pendimethalin	Taloka sil	---	---	---	.56	.1695
Piclorám		---	---	Arid range	1.05	.2689
Picloram		---	---	---	---	.0712
Profluralin	Taloka sil	---	---	---	.74	.2434
Prometryne	Taloka sl	7.2	2	---	---	.0127
Pronamide	Taloka sl	6.1	2	---	4.5	.0203 2/ .0603
Pronamide	Newport sl	---	---	---	4.5	.0173 3/
Propham	New Ya'ar c (dry)	---	---	---	.56	.025 4/
Propham	New Ya'ar (wet)	---	---	---	.56	.279 4/

Table D-5, continued.

Pesticide	Soil: Location or series 1/	Soil: pH	Soil: OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
HERBICIDES, continued.						
Silvex (spray)	Galestown sl	6.7	5.2	Bluegrass	2	.0213
Silvex (granules)	Galeston	6.7	5.2	Bluegrass	1.3	.0346
Simazine	Galestown sl	7	2	---	---	.0089
2,4,5-T (isooctyl)		5.8	2.6	---	1.1-	.0266-
		---	---	---	4.3	.075
2,4,5-T		---	---	---		.0674
2,4,5-T		---	---	Arid range	1.07	.1323
Trifluralin	Bosket sl	5.8	2.6	Bluegrass	.86-	.0748
					1.12	.0681 4/
Trifluralin	(Bushland) cl	---	---	Cotton	.56	.0299 4/
Trifluralin	(Lubbuck)	---	---	Cotton	.56	.0599 4/
Trifluralin	Taloka sl	---	1.0	---	.56	.1729
Trifluralin	Sheep pens (dry)	6.3	2.0	---	---	.0071 2/
Trifluralin	Sheep pens (wet)	---	2.0	---	---	.0956
INSECTICIDES						
Aldrin	Coachella fs	---	---	---	20.2	0.2406
Aldrin (+dieldrin) (granules)	Carrington sil	---	---	---	5.6	.0045 2/
Azinphosmethyl (spray)	Orchard sl	6.6-7.8	3.4	---	---	.0486 4/
Azinphosmethyl (spray)	Orchard sl	6.6-7.8	3.4	---	---	.0434 4/
Carbofuran	Alluvial	6.2	1.6	---	---	.0075
Carbofuran	Ritzville sil	7.8	1.0	---	2.0	.0690
Carbofuran	Chehalis c	6.2	7.2	---	2.0	.0180
Carbofuran	Organic	5.9	4.0	---	2.0	.0048
Carbofuran	Sultan sil	4.3	3.0	---	2.0	.034
Carbofuran	Sultan sil	6.0	3.0	---	2.0	.086
Carbofuran	Sultan sil	6.0	3.0	---	2.0	.0040
Carbofuran	Sultan sil	6.8	3.0	---	2.0	.0059
Carbofuran	Sultan sil	7.8	3.0	---	2.0	.0132
Chlordane	Gullatin Valley	---	---	Alfalfa	2.0	.0101 4/
Chlordane	Gullatin Valley	---	---	Alfalfa	>2	.007 4/
DDT	sl	---	---	---	83	.004 2/
DDT	Choachella fs	---	---	---	22.4	.053 2/
DDT	Houston c	>7	---	---	---	.0060
DDT	Pima sic	>7	---	---	---	.0049
DDT	Pinal gl	>7	---	---	---	.0060
DDT	Blackwater River	<7	---	Forest	1.12	.00015 3/
DDT	Pollard Mountain	<7	---	Forest	1.12	.000023
DDT	Mosquito Bnk Pod	<7	---	Forest	1.12	.00040
DDT	Route 11	<7	---	Forest	1.12	.00014 4/
DDT	West Oxbow	<7	---	Forest	1.12	.00024 4/
DDT	Black Mountain	<7	---	Forest	1.12	.00044

Table D-5, continued.

Pesticide	Soil			Crop or conditions	Application rate	k_s
	Location or series 1/	pH	OM			
			(%)		(kg/ha)	
INSECTICIDES, continued.						
Diazinon------------	Reaville shl	---	---	---	15.7	.1422 3/
Endrin--------------	Mhoon sicl	6.0	1.2	Sugarcane	---	.0110
Endrin--------------	Coachella fs	---	---	---	5.4	.2436
Ethion--------------	Vineyard	---	---	Grapes	1.12	.0647 2/
Ethyl parathion-----	San Joaquin l	7.2	1.2	Citrus	2.24	.0332
						(.0725) 5/
Ethyl parathion-----	San Joaquin l	7.2	1.2	Citrus	4.48	.0328
						(.0084) 5/
Ethyl parathion-----	San Joaquin l	7.2	1.2	Citrus	8.96	.0282
						(.0114) 5/
Hexachlorobenzene---	Chewada sl	---	---	Zoysia	---	.050 3/
Methyl parathion----	Houston c	>7	---	---	---	.0165
Methyl parathion----	Pima sic	>7	---	---	---	.0153
Methyl parathion----	Pinal gl	>7	---	---	---	.0147
Parathion-----------	sl	4.7-7.3	1.0-3.4	---	---	.0058 3/
Toxaphene-----------	Galestown sl	6.7	5.2	Cotton	(6x2.7)	.0046

1/ si = silt; s = sand; sh = shale; c = clay; l = loam; f = fine; g = gravelly

2/ Correlation coefficient r = -0.8

3/ Correlation coefficient r = -0.9

4/ Correlation coefficient r = unknown

5/ Paraoxin

Table D-6--Effect of soil type, organic matter content, moisture content, temperature, and pH on dissipation (k_s values) of pesticides in soils 1/

Pesticide	Soil			Temperature													
				5°C		10°		14-15°C		20°C		25°C		28-30°C		40°C	
	Type	pH	OM	SM 2/	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s
				(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Pronamide	Gravel Pits sl	6.1	1.8					11.7	0.0091			4.1	0.0116				
Pronamide	Little Cherry sl	6.9	1.4					12.0	.0099			4.0	.0096				
Pronamide	Soakwaters cl	6.1	1.4					17.8	.0110			6.4	.0124				
Pronamide	Gallas Ley sc	6.9	2.9					16.7	.0062			6.2	.0074				
Pronamide	Water Meadows cl	7.2	5.3					29.5	.0082			14.8	.0142				
Pronamide	Gravel Pits sl	6.1	1.8									11.9	.0217				
Pronamide	Little Cherry sl	6.9	1.4									12.1	.0231				
Pronamide	Soakwaters cl	6.1	1.4									16.3	.0301				
Pronamide	Gallas Ley sl	6.9	2.9									16.7	.0165				
Pronamide	Water Meadows cl	7.2	5.3									29.1	.0198				
Pronamide	Little Cherry sl	6.1	2.0					7.5	.0062					3.5	0.0077		
Pronamide	Little Cherry sl	6.1	2.0											7.5	.0110		
Pronamide	Little Cherry sl	6.1	2.0											10.0	.0127		
Pronamide	Little Cherry sl	6.1	2.0														
Asulam	Regina c	7.7	7.2			20	0.0141	20	.0261	20	0.0440	20	.0590	20	.582	20	0.0774
Asulam	Regina c	7.7	7.2			26	.0290	26	.0397	26	.0564	26	.0723	26	.0596	26	.0792
Asulam	Regina c	7.7	7.2			34	.0358	34	.0504	34	.0981	34	.0957	34	.1052	34	.0814
Asulam	Regina c	7.7	7.2			40	.0386	40	.0525	40	.1127	40	.0970	40	.1174	40	.0868
Linuron	Gravel Pits sl	7.0	2.0	4.0	0.0065	4.0	.0083	4.0	.0.04	4.0	.0122	4.0	.0154	4.0	.0293		
Linuron	Gravel Pits sl	7.0	2.0									8.0	.0165				
Linuron	Gravel Pits sl	7.0	2.0	12.0	.0084	12.0	.0110	12.0	.0131	12.0	.0162	12.0	.0187	12.0	.0193		
Linuron	Gravel Pits sl	7.0	2.0									16.0	.0204				
Simazine	Gravel Pits sl	7.0	2.0	4.0	.0033	4.0	.0050	4.0	.0075	4.0	.0116	4.0	.0173	4.0	.0239		
Simazine	Gravel Pits sl	7.0	2.0									8.0	.0248				

Table D-6, continued.

Pesticide	Soil			Temperature													
				5°C		10°		14-15°C		20°C		25°C		28-30°C		40°C	
	Type	pH	OM	SM 2/	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s	SM	k_s
				(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Simazine	Gravel Pits sl	7.0	2.0	12.0	.0056	12.0	.0087	12.0	.0131	12.0	.0204	12.0	.0267	12.0	.0433		
Simazine	Gravel Pits sl	7.0	2.0									16.0	.0301				
Simazine	Gravel Pits sl	7.0	2.0									4.8	.0082				
Simazine	Gravel Pits sl	7.0	2.0					6.6	.0030			6.0	.0091				
Simazine	Gravel Pits sl	7.0	2.0									7.9	.0109				
Simazine	Gravel Pits sl	7.0	2.0									9.7	.0131				
Simazine	Gravel Pits sl	7.0	2.0									10.7	.0149				
Prometryn	Gravel Pits sl	7.0	2.0									11.2	.0176				
Prometryn	Gravel Pits sl	7.0	2.0					11.5	.0062			11.4	.0191				
Prometryn	Gravel Pits sl	7.0	2.0									13.2	.0188				
Prometryn	Gravel Pits sl	7.0	2.0									4.8	.0012				
Prometryn	Gravel Pits sl	7.0	2.0					6.6	.0014			6.0	.0029				
Prometryn	Gravel Pits sl	7.0	2.0									7.9	.0084				
Prometryn	Gravel Pits sl	7.0	2.0									9.7	.0152				
Prometryn	Gravel Pits sl	7.0	2.0									10.7	.0167				
Prometryn	Gravel Pits sl	7.0	2.0									11.2	.0234				
Prometryn	Gravel Pits sl	7.0	2.0									11.4	.0276				
Prometryn	Gravel Pits sl	7.0	2.0									13.2	.0229				
Carbofuran	sil	4.3	---							---	0.0234						
Carbofuran	sil	6.0	---							---	.0261						
Carbofuran	sil	6.8	---							---	.0421						
Carbofuran	sil	7.8	---							---	.1020						

1/ Adapted from CRR 26, p. 565-566.

2/ Soil moisture.

Table D-7.--Values of k_s for dissipation of pesticides in soil
(Adapted from CRR 26, p. 568-574)

Pesticide	Soil Type		Soil pH	Soil OM 1/	Crop or conditions	Application rate	k_s
				(%)		(kg/ha)	
FUNGICIDES							
BAS 3460F	Potting Soil				Agonis Flexuosa		0.0822
Benomyl	Potting Soil				Agonis Flexuosa		.1486
Benomyl		sl					.0058
Benomyl		l					.0023
HERBICIDES							
Alachlor							.0384
Amitrole							.0768
Arsenic acid							<.0064
Asulam	Regina	c	7.7	4.2	14 May		.0986
Asulam	Regina	c			12 July		.0519
Asulam	Regina	c	7.7	4.2	30 July		.0310
Atrazine		sl	4.8	1.0			.0131
Atrazine	Regina	c	6.5	2.0			.0063
Atrazine							.0064
Atrazine	Norfolk	sl	6.8			~5.2	.0133
Atrazine	Decatur	cl	6.4			~5.2	.0149
Benefin							.0053-.0077
Benefin							.0077-.0070
Bifenox	Potting soil mixture				Various	1.7	.142
Butralin							.0128
Butralin							.0077
Cyanazine							.0064
Di-Allate	Weyburn	l	6.5	6.5	None	2.8	.0138
Di-Allate	Weyburn	l	7.0	4.5	Laboratory	.65	.0248
Di-Allate	Regina	c	7.5	4.0	Laboratory	.65	.0180
Di-Allate	Regina	c	7.8	4.2	None	2.2	.0110
Dicamba	Asquithse		7.5	3.2	5% moisture	.25	.0197
Dicamba	Asquithse		7.5	3.2	10% moisture	.25	.2140 2/
Dicamba	Meltfort	sic	5.2	11.7	Various moisture	.25	>.2140 2/
Dicamba	Regina	c	7.7	4.2	25% moisture	.25	.0486
Dicamba	Regina	c	7.7	4.2	35% moisture	.25	.0902
Dicamba	Ouachita	cl		3.3	Forest	.3	.0217
Dicamba	Ouachita	cl		2.8	Grass	.3	.0407
Dicamba	Cross Timbers	l		3.8	Forest	.3	.0267
2,4-D	Cross Timbers	l		3.8	Forest	.6	.1733
2,4-D acid	Cross Timbers	l					>.0768
2,4-D	Cross Timbers	l		3.3	Forest	.6	.1386
2,4-D salt							.0768
2,4-D	Ouachita	cl		2.8	Grass	.6	.1733
2,4-D ester							>.0768
2,4-D isooctyl ester	Naff	sil		3.2	Laboratory 30°C	15	.2546
2,4-D	Naff	sil		3.2	Laboratory 10°C	15	.2731
2,4-D amine	Naff	sil		3.2	Laboratory, carboxyl-^{14}C	12.5	.1457
2,4-D amine	Naff	sil		3.2	Laboratory, carboxyl-^{14}C	12.5	.1008

Table D-7, continued.

Pesticide	Soil Type		pH	OM	Crop or conditions	Application rate	k_s
				(%)		(kg/ha)	
HERBICIDES, continued.							
2,4-D isooctyl ester α amine.	Naff	sil		3.2	Laboratory carboxyl ^{14}C	12.5	.0951
2,4-D isooctyl ester α amine.	Naff			3.2	Laboratory carboxyl ^{14}C	12.5	.0555
2,4-D isooctyl ester α amine.				3.2	Laboratory Ring ^{14}C	12.5	.0852
2,4-D isooctyl ester α amine.				3.2	Laboratory Ring ^{14}C	12.5	0.0257
Dichlorprop---------	Ouachita	sl		3.3	Forest	.6	.0578
Dichlorprop---------	Ouachita	sl		2.8	Grass	.6	.0866
Dichlorprop---------	Cross Timbers	l		3.8	Forest	.6	.0693
Dinitramine							.0193
Dinitramine							.0193
Diuron--------------	Norfolk	cl	6.8			~5.2	.0064
Diuron--------------	Decatur	cl	6.4			~5.2	.0072
EPTC----------------	Regina	c	7.5	4.0	Laboratory	.65	.0220
EPTC----------------	Weyburn	l	7.0	4.5	Laboratory	.65	.0248
Fluchloralin							.0070 2/
Fluchloralin							.0045 2/
Isopropalin---------	Daummer	sic	6.7	5.1	Various		.0023-
Osopropalin---------	Eisne	sil	7.2	1.6			.0036
							.0054 2/
							.0040
Isopropalin---------	Ochley	sil	4.7	2.9	Sorghum	1.68	.0304
Isopropalin---------	Ochley	sil	4.7	2.9	Sorghum	3.36	.0214
Isopropalin---------	Bloomfield	fs	6.3	.6	Sorghum	1.12	.0275
Karbutilate---------		cl	6.3	2.2	Rangeland		.0057-
							.0282
Karbutilate---------		lc	6.2	1.1	Rangeland		.0118
Linuron					Cropped		.0104- 3/
							.0231
Linuron----------------		ls			Noncropped		.0047
Linuron----------------		cl	7.0	2.0	Carrots	.85	.0280 3/
Linuron----------------		cl	7.0	2.0	None	3.4	.0039 3/
Linuron-------------	0-5 cm		7.0	2.0	None	3.4	.0061 3/
MCPA----------------	Coarse	cl	7.0	2.0	Barley	1.7	[illegible]
MCPA----------------	Coarse	cl	7.0	2.0	None	3.4	
Metribuzin							
Metobromuron--------		sl	4.8	1.0			
Metobromuron--------		sl	6.5	2.0			
Monolinuron							
Monuron-------------	Romona	sl			Various	2.24	
Monuron-------------	Romona	sl				4.48	
Neburon-------------	Romona	sl			Various	2.24	
Neburon-------------	Romona	sl			Various	4.48	
Nitralin							
Nitralin							

Table D-7, continued.

Pesticide	Soil Type	pH	OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
HERBICIDES, continued.						
Nitralin------------	Ochley sil	4.7	2.9	Sorghum	1.12	.0110
Nitralin------------	Ochley sil	4.7	2.9	Sorghum	1.12	.0079
Nitralin------------	Ochley sil	4.7	2.9	Sorghum	2.24	.0090
Nitralin------------	Ochley sil	4.7	2.9	Sorghum	2.24	.0024
Nitralin------------	Bloomfield fs	6.3	.6	Sorghum	.56	.0155
Nitralin------------	Bloomfield fs	6.3	.6	Sorghum	1.12	.0091
Oryzalin------------	Bloomfield fs					.0054- 2/ .0083
Oryzalin						.0144- .0056
Pebulate------------	Regina c	7.5	4.0	Laboratory	.65	.0396
Pebulate------------	Weyburn l	7.0	4.5	Laboratory	.65	.0396
Picloram--------	Scot l, oxbows cl			Various		.0025 .0083 2/ .0056 2/
Pebulate------------	Regina c	7.5	4.0	Laboratory	.65	0.0396
Pebulate------------	Weyburn l	7.0	4.5	Laboratory	.65	.0396
Picloram-------	Scot l, oxbows cl			Various		.0025
Picloram------------	Various					.00772 2/
Picloram-------	Nova Scotia cl				4.8	.0044
Picloram------------	Somerset sl	4.8	2.9	Fallow	4.48	.0050
Picloram------------	Farin cl	6.3	1.9	Orchard grass	2.24	.0354
Picloram------------	Chandler f sl	5.5	1.7	Orchard grass	2.24	.0258
Picloram------------	Chester l	5.8	1.9	Orchard grass	2.24	.0268
Picloram------------	Chester l	5.8	1.9	Orchard grass	4.48	.0269
Picloram------------	Various	Various			.05	.004 2/
Picloram------------	Ouachita cl		3.3	Forest	.6	.0019 3/
Picloram------------	Ouachita cl		2.8	Grass	.6	.0048
Picloram------------	Cross Timbers l		3.8	Forest	.6	.0028
Profluralin						.0047 2/
Profluralin						.0051 2/
Pometryne-----------	sl	7.0	2.0			.0238
Propazine-----------	sl	4.8	1.0			.0108
Propazine		6.5	2.0			.0056
Propyzamide---------	c to sl			Lettuce		.0061- .0158 4/
Silvex--------------	Ouachita sl		3.3	Forest	.6	.0330
Silvex--------------	Ouachita sl		2.8	Grass	.6	.0495
Silvex--------------	Cross Timbers l		3.8	Forest	.6	.0462
Simazine		7	2	None	3.4	.0074 4/
Simazine------------	0 to 5 cm	7	2	None	3.4	.0083
Simazine------------	sl	4.8	1.0			.0116
Simazine------------	sl	6.5	2.0			.0082
Simazine				Cropped		.0539
Simazine				Noncropped		.062
Simazine------------	sl	7.0	2.0			.0187
Tebuthiuron---------	Various			Corn	.025	.0024
Tebuthiuron------	Houston Black c, Udic Pellustert			In surface runoff water.	2.24	.0060

Table D-7, continued.

Pesticide	Soil			Crop or	Application	k
	Type	pH	OM	conditions	rate	s
			(%)		(kg/ha)	
HERBICIDES, continued.						
Tebuthiuron------	Houston Black Udic Pellustert			In surface pellets.	2.24	.0427
Tebuthiuron------	Houston Black Udic Pellustert			In surface Broadcast spray.	2.24	.0201
Tebuthiuron------	Houston Black Udic Pellustert			In pellets	2.24	.0517
Tebuthiuron------	Houston Black Udic Pellustert			In surface band pellets.	2.24	.0624
Tebuthiuron------	Houston Black Udic Pellustert			Broadcast in soil spray.	2.24	.0069
Triallate-----------	Regina c	7.5	4.0	Laboratory	.65	.0090
Triallate-----------	Weyburn l	7.0	4.5	Laboratory	.65	.0110
Triallate-----------	Coarse sl	7.0	2.0	Barley	1.7	.0144 3/
Triallate-----------	Coarse sl	7.0	2.0	None	3.4	.0067 3/
Triallate-----------	Weyburn l	6.5	6.5	None	2.8	.0088
Triallate-----------	Regina c	7.8	4.2	None	2.2	.0053
2,4,5-T-------------	Ouachita sl		3.3	Forest	.6	.0289
2,4,5-T-------------	Ouachita sl		2.8	Grass	.6	.0330
2,4,5-T-------------	Cross Timbers l		3.8	Forest	.6	.0330
2,4,5-T-------------	Fanin cl	6.3	1.9	Orchard grass	2.24	.0508 3/
2,4,5-T-------------	Chandler fls	5.5	1.7	Orchard grass	2.24	.0495
2,4,5-T-------------	Chester l	5.8	1.9	Orchard grass	2.24	0.0416 3/
2,4,5-T-------------	Chester l	5.8	1.9	Orchard grass	4.48	.0414
Trifluralin						.0037- 2/
Trifluralin						.0047
Trifluralin						.0051- 2/ .0044
Trifluralin---------	Cecil sl	6.5	.6	Soybeans		.0175
Trifluralin---------	Wet soil			None		.0956-
Trifluralin---------	Dry soil			None		.0189 4/
Trifluralin---------	Ochley sil	4.7	2.9	Sorghum	.84	.0145
Trifluralin---------	Ochley sil	4.7	2.9	Sorghum	.84	.0117
Trifluralin---------	Ochley sil	4.7	2.9	Sorghum	1.68	.0104
Trifluralin---------	Ochley sil	4.7	2.9	Sorghum	1.68	.0026
Trifluralin---------	Bloomfield fs	6.3	.6	Sorghum	.56	.0155
Trifluralin---------	Bloomfield fs	6.3	.6	Sorghum	1.12	.0091
Vernolate-----------	Regina c	7.5	4.0	Laboratory	.65	.0396
Vernolate-----------	Weyburn l	7.0	4.5	Laboratory	.65	.0396
INSECTICIDES						
Aldicarb------------	Beaumont c	5.4			130	.00273
Aldicarb------------	Houston c	7.8			130	.0087
Aldicarb------------	Houston cl	7.5	.25	Shendi	.5	.0991 3/
Aldicarb------------	Houston cl	7.5	.25	Shendi	1.0	.0420
Aldicarb------------	Houston cl	7.5	.25	Orange	2.8-22.4	.0322- <.0032
Aldrin--------------	Ulysses sil			Fallow	2.24	.0264
Aldrin--------------	Knox sil			Fallow	2.24	.0259
Aldrin--------------	Celeryville muck			Fallow	2.24	.0014 4/
Aldrin--------------	Marietta sl			Fallow	2.24	.0136

Table D-7, continued.

Pesticide	Soil Type	pH	OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
INSECTICIDES, continued.						
Aldrin--------------	Fox fsl			Fallow	2.24	.0256
Aldrin--------------	Miami sil			Fallow	2.24	.0258
Aldrin--------------	Muck			Fallow	2.24	.0066 4/
Aldrin--------------	Carrington sil	Nondisked		Fallow	4.5	.0101 2/
Aldrin--------------	Carrington sil	Disked		Fallow	4.5	.0136 2/
Aldrin--------------	Udaipur cl	7.8	1.6	Various	3.0	.0149
						x̄ of 19
						x̄ of 19
Aldrin--------------	Jobner	8.6	.26	Various	3.0	.0165
						x̄ of 19
Aldrin--------------	Muck				22.4	.0061
Aldrin--------------	Miami sil				22.4	.0096
Aldrin--------------	Composite				22.4	.0038
Aldrin (Dieldrin)----------	Carrington sil	Nondisked			4.5	.0006 4/
Aldrin (Dieldrin)----------	Carrington sil	Disked			4.5	.0008 4/
Aldrin (Dieldrin)----------	Carrington sil	Disked		Granules	5.6	.0012 4/
Aldrin (Dieldrin)----------	Carrington sil			Spray		.0017 4/
Akton---------------	Sultan sil	6.3	3.4	Corn granules	2.24	.0032
Azinphosmethyl		8.4				.0239
Azinphosmethyl------	Orchard sl	6.6-7.8	3.4			.0026 4/ 5/
Azinphosmethyl------	Orchard sl	6.6-7.8	3.4			.0014 4/ 6/
Azinphosmethyl------	Gila sil				.018	.0533
Azinphosmethyl------	Mocha sil					.0273
Azinphosmethyl------	Linne c					.0516
Azinphosmethyl------	Madera sl					.0086
Azinphosmethyl------	Laveen sl					.0119
Azinphosmethyl------	Santa Lucia sill					.0235
Azinphosmethyl------	Windy l					0.0074
Azinphosmethyl------	fsl					.0101
Azinphosmethyl------	sicl					.0458
Azinphosmethyl------	c					.0505
Azinphosmethyl------	sl					.0211
BHC						.0021
BHC----------------	Udaipur	7.8	1.6	Various	5.0	.0140
BHC						x̄ of 19
BHC----------------	Jobner sl	8.6	.26	Various	5.0	.0098
						x̄ of 19
BHC alpha-----------	Berwick sl			Vegetables	7.4 BHC	.0006 5/
BHC beta------------	Berwick sl			Vegetables	7.4 BHC	.00015 2/
BHC gamma-----------	Berwick sl			Vegetables	7.4 BHC	.00042 2/
BHC delta-----------	Berwick sl			Vegetables	7.4 BHC	.00036 2/
Bromophos-----------	Composite					.0198
Carbaryl						.0768
Carbaryl------------	Updaipur cl	7.8	1.6	Various	15.0	.1196
						x of 8
Carbaryl------------	Jobner sl	8.6	.26	Various	15.0	.0169
						x̄ of 8

Table D-7, continued.

Pesticide	Soil Type	pH	OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
INSECTICIDES, continued.						
Carbofuran						.0768
Carbofuran-----------	Take sil				10.0	.0079
CGA-12223-----------	sil	4.8	1.0			.0385
CGA-12223 7/--------	sil	6.5	2.2			.0693
Chlordane-----------	Berwick sl				2.0	.00072 2/
Chlordane-----------	Composite					.0020
Chlorfenvinphos						.0055
Diazinon------------	Composite					.0330
Diazinon------------	Sultan sil	6.7	3.1	25°C		.0151
Diazinon------------	Sultan sil	6.7	3.1	15°C		.0067
Diazinon------------	Sultan sil	4.3	3.1			.0242
Diazinon------------	sl	4.8	1.0			.0239
Diazinon------------	sl	6.5	2.0			.0239
Diazinon------------	sl	6.5	2.0			.0248
Diazinon------------	Puyallup sl	5.0	2.1			.0189
Diazinon------------	Puget sil	5.4	3.0			.0260
Diazinon------------	Chehalis cl	5.6	7.2			.0166
Diazinon------------	Organic	5.4	40			.0171
Dieldrin------------	Carrington sil	Nondisked		Fallow	4.5	.0142 2/
Dieldrin------------	Carrington sil	Disked		Fallow	4.5	.0187 2/
Dieldrin						.0003 3/
Dieldrin------------	Imperial sc	7.8	1.0		20.0	.0002
Dieldrin------------	Holtville fsl	7.8	.5		20.0	.0001
Dieldrin------------	Composite					.0008
Dioxacarb-----------	sl	4.8	1.0			.0248
Dioxacarb-----------	sl	6.5	2.0			.3465
Dioxathion----------	fsl					.0156
Dioxathion----------	sicl					.0128
Dioxathion----------	c					.0141
Dioxathion----------	sl					.0229
p,p'-DDT------------	Ulysses sil	6.9	1.8	Fallow	9.4	.0008 3/
p,p'-DDT------------	Knox sil	6.8	.8	Fallow	9.4	.0005 3/
p,p'-DDT------------	Celeryville much	4.9	74.5	Fallow	9.4	.0021
p,p'-DDT------------	Marietta sl	6.0	2.0	Fallow	9.4	.0014 3/
p,p'-DDT------------	Fox fsl	7.2	.8	Fallow	9.4	.0009
p,p'-DDT------------	Miami sil	7.1	3.6	Fallow	9.4	.0004 3/
p,p'-DDT------------	Muck	6.8	40.0	Fallow	1.0	.0009
p,p'-DDT------------	Commerce sil				24.4	.0037
p,p'-DDT------------	Carrington sil	Nondisked			4.5	.0024 2/
p,p'-DDT------------	Carrington sil	Disked		Fallow	4.5	.0048 2/
p,p'-DDT------------	Miami sil				11.6	0.0003
p,p'-DDT------------	Carrington sil	Disked/non-disked		Fallow	4.5	.0002 4/
p,p'-DDT------------	Muck				11.2	.0011
p,p'-DDT------------	Miami sil				11.2	.0029
p,p'-DDT------------	Berwick sl				37 DDT	.00016 2/
p,p'-DDT------------	Composite					.0007
o,p'-DDT------------	Berwick sl					.00029 2/
Dimethoate----------	Composite					.0990
Disulfoton				Various		.1604

Table D-7, continued.

Pesticide	Soil Type	pH	OM	Crop or conditions	Application rate	k_s
			(%)		(kg/ha)	
INSECTICIDES, continued.						
Endosulfan	Various				1.3	.0162
Ethion	Mocho sil					.0014
Ethion	Linne c					.0012
Ethion	Madera sl					.0009
Ethion	Laveen sl					.0015
Ethion	Santa Lucia sil					.0014
Ethion	Windy l					.0015
Ethion	fsl					.0009 3/
Ethion	sicl					.0022
Ethion	c					.0032
Ethion	sl					.0025
Fenitrothion	sl	4.8	1.0			.0578
Fenitrothion	sl	6.5	2.0			.1155
Fonofos	Take sil	8.5			10	.0158
Heptachlor	Composite					.0021
Heptachlor	Composite					.0025
Heptachlor	Composite					.0028
Hexachlorobenzene	Chevada			Zoysia		.0006 3/
Isobenzan	Composite					.0050
Lindane	Imperial sc	7.8	1.0		20	.0022
Lindane	Hoytville fsl	7.8	.5		20	.0026
Lindane	Composite					.0017
Lindane	Gila sil	7.7	.6	None		.0046 2/
Lindane	Miami sil				11.6	.0011
Lindane	Muck				11.2	.0014
Lindane	Miami sil				11.2	.0048
Lindane	Ulysses sil			Fallow	1.12	.0147
Lindane	Knox sil			None	11.2	.0264
Lindane	Celeryville much			None	11.2	.0074
Lindane	Marietta sl			None	11.2	.0263
Lindane	Fox fsl			None	11.2	.0264
Lindane	Miami sil			None	11.2	.0139
Lindane	Muck			None	11.2	.0059 3/
Malathion	Poygan sicl	7.2		None		2.9173
Malathion	Kewaune c	6.4		None		2.4618
Malathion	Ella ls	3.8		None		1.2681
Malathion	Freestone sl	5.3	1.1	None		.4152
Malathion	Okolona c	7.4	3.1	None		1.9832
Malathion	Trinity l	7.1	4.7	None		1.9026
Mecarbam	Composite					.0495
Methidathion	sl	4.8	1.0			.0108
Methidathion	sl	6.5	2.0			.0495
Methoxychlor		4.8	1.0			.0046
Methoxychlor		6.5	2.0			.0033
Methyl Parathion	Carrington l			Radishes	5.6	.2207
Mevinphos	Sacramento s	5.4	.4		13	.2936
Parathion	Carrington l			Radishes	5.6	.0248
Parathion						.056
Parathion	Mocho sil	7	.6	None		.0046 2/
Parathion	Udaipur cl	7.8	1.6	Various	10	.1239 $\bar{x}$ of 8

Table D-7, continued.

Pesticide	Soil			Crop or conditions	Application rate	k_s
	Type	pH	OM			
			(%)		(kg/ha)	
INSECTICIDES, continued.						
Parathion-----------	Jobner sl	8.6	.26	Various	10	.0727 $\bar{x}$ of 7
Parathion-----------	Mocho sil					0.1371 3/
Parathion-----------	Linne c					.1306
Parathion-----------	Madera sl					.0944 3/
Parathion-----------	Laveen sl					.1150 3/
Parathion-----------	Santa Lucia sil					.0866
Parathion-----------	fsl	6.8	0.8			.0654
Parathion-----------	sicl	7.3	2.1			.0891 3/
Parathion-----------	c	7.3	2.3			.2962
Parathion-----------	sl	7.6	1.8			.2614
Phenthoate----------	fls	6.8	.8			.2865
Phenthoate----------	sicl	7.3	2.1			.0156
Phenthoate----------	c	7.3	2.3			.0141
Phenthoate----------	sl	7.6	1.8			.0229
Phorate-------------	Sacramento muck				13	.0040
Phorate-------------	Sacramento peat				13	.0043 2/
Phorate-------------	Sacramento peat				13	.0051 2/
Phorate-------------	Take sil	8.5			10	.0363 3/
Phorate-------------	Sacramento s				13	.0078 4/
Phorate-------------	Sacramento c				13	.0277
Zinophos------------	Sultan sil	6.7	3.1	25°C		.0223 3/
Zinophos------------	Sultan sil	6.7	3.1	15°C		.0164
Zinophos------------	Sultan sil	5.5	3.1			.0144
Zinophos------------	Sultan sil	8.1	3.1			.0244
Zinophos------------	Sultan sil					.0096
Zinophos						.0133
Zinophos						.0206
Zinophos						.0075
NEMATICIDES						
Dichlofenthion------	Composite					.0031
Trichloronate-------	Composite					.0050

1/ Organic matter.
2/ Unknown.
3/ r = <-0.9.
4/ r = <-0.8.
5/ Emulsifiable concentrate formulation.
6/ Wettable powder formulation.
7/ Diethyl (1-iso-propyl-5-chloro-1,2,4-triazolyl-3) phosphorothioate.

Table D-8.--Parameters and statistical information provided for the relation: K_d = m %OC + b (after deleting high k_d values) 1/

Pesticide	Slope m 2/	Intercept b 2/	Coefficient of determination	F value for the relation 2/	Mean K_d ± one standard deviation	Number of observations
Aldrin - - - - - -	.2650	2.52*	.802	4.05 ns	2.8 ± .16	3
Ametryne - - - - -	2.32*	1.96	.169	6.9*	6.0 ± 3.6	36
Atrazine - - - - -	0.628**	1.33**	.546	58.**	2.9 ± 1.8	50
Benefin - - - - - -	4.22**	5.07+	.815	35.**	16.7 ± 4.3	10
Carbofenthion - - -	125.	90.	.164	.39 ns	124 ± 81.	4
Choramben - - - - -	.020	.00	.000	.000		9
Chlorbromuron - - -	5.52+	5.14	.614	6.4+	18.9 ± 4.7	6
Chloroxorun - - - -	30.4	44.8	.903	28.*	234. ± 60.	5
Ciodrin - - - - - -	.5703	4.31+	.932	13.6 ns	6.0 ± .55	3
CIPC - - - - - - -	2.86**	-.15	.803	122.**	4.3 ± 1.5	32
DDT - - - - - - - -	2333.	1690.	.998	444.*	42000. ± 4000.	3
Dicamba - - - - - -	.040**	.097**	.945	187.**	.077 ± .061	13
Dieldrin - - - - -	59.1**	325.**	.954	124.**	638. ± 101.	8
Dinitramine - - - -	2.44**	.64	.727	21.**	7.4 ± 3.2	10
Disulfoton - - - -	6.25**	8.64**	.907	132.**	36.8 ± 9.4	16
Diuron- - - - - - -	3.34**	.44	.426	67.**	5.4 ± 3.6	92
Ethion - - - - - -	70.7	26.2	.416	1.43 ns	45.7 ± 24.	4
Fluchloralin - - -	1.78*	4.23	.417	5.7**	9.1 ± 4.5	10
Fluometuron - - - -	1.12+	-.47	.977	43.+	2. ± .23	3
Lindane - - - - - -	6.52**	5.6**	.720	59.**	21.9 ± 6.9	25
Linuron - - - - - -	5.57**	5.2	.585	41.**	20.5 ± 15.5	31
Monuron - - - - - -	2.36**	-.48	.711	37.**	7.6 ± 5.4	17
Oryzalin- - - - - -	1.63**	-.50	.897	70.**	4.0 ± 1.2	10

Table D-8, continued.

Pesticide	Slope m 2/	Intercept b 2/	Coefficient of determination	F value for the relation 2/	Mean K_d ± one standard deviation	Number of observations
Parathion - - - - -	24.1**	-8.3	.693	29.4**	33.7 ± 33.7	15
Phorate - - - - - -	17.5	4.55	.522	2.18 ns	9.4 ± 4.9	4
Picloram - - - - -	.123**	.14	.206	8.8**	0.39 ± .45	36
Profluralin - - - -	5.12**	8.38	.610	12.5**	22.4 ± 8.8	10
Prometone - - - - -	2.75+	1.6	.115	3.4+	5.5 ± 5.	28
Prometryne- - - - -	3.94**	1.72	.283	11.4**	7.6 ± 4.4	30
Propazine - - - - -	1.14**	.48	.548	33.**	2.1 ± .7	29
Pyrazon - - - - - -	.636*	2.11	.770	10.*	4.6 ± 1.6	5
Simazine - - - - -	.636**	1.16	.106	18.**	2.3 ± 2.4	151
Trifluralin - - - -	5.09**	5.21	.784	29.0**	19.2 ± 5.7	10
2,4-D - - - - - - -	.194**	.01	.736	70.**	.74 ± .5	27
2,4,5-T - - - - - -	.606**	.0022	.787	30.**	1.13 ± .65	10

1/ Adapted from CRR 26, p. 613-614. From visual inspection of scatter diagrams, high or dominating K_d values were deleted from the analysis if, as a group, they appeared to be of a different statistical population.

K_d is the distribution coefficient of the pesticide between sediment and water phase where (1) the relationship between adsorbed and solution equilibrium concentrations as a function of different pesticide concentrations are linear, or (2) the distribution is determined at equilibrium solution concentration of 1.0 mg/l. Percent OC is organic carbon determined directly or by % organic matter ÷ 1.732; the m and b values are the slope and intercept, respectively, as fitted by regression.

2/ ns or unmarked means not significant; +, *, **, significant at the 10, 5, and 1% level, respectively.

Table D-9.--Pesticide removal from foliage by rainfall 1/

Class and pesticide	Time after pesticide application	Rainfall Amount	Rainfall Method of application	Dislodgeable residues removed
	(days)	(cm)		(percent)
Organophosphates:				
Phenthoate	3	0.28	Oscillating boom sprayer	68
Phenthoate	10	.28	Oscillating boom sprayer	71
Parathion	48	6.40	Natural	65
	22	6.40	do.	70
	3	.38	Oscillating boom sprayer	60
Azinphosmethyl	3	.33	do.	60
Dioxathion	4	--	do.	56
	10	--	do.	37
Carbamates:				
Benomyl	13	1.34	"Sprinkling" (simulated rain)	55
Organochlorines:				
Toxaphene	2/	2.54	Rainfall simulator	5
Other				
Diflubenzuron	14	7.60	Natural	70

1/ Adapted from CRR 26, p. 602.

2/ 2 hours.

Table D-10.--Interception of pesticides by plants 1/

Pesticide	Application mode	Target	Amount of pesticide applied on target
			(percent)
Organochlorine			
DDT	Ground applicator	Paper sheet 2/	35
Kelthane	do.	Paper sheet 2/	44
Toxaphene	do.	Paper sheet 3/	65
Toxaphene	do.	Paper sheet 4/	62
DDT	do.	Cotton 5/	12
Toxaphene	do.	do.	28
Toxaphene	do.	do.	25
DDT	do.	Cotton 6/	39
DDT	do.	Cotton 7/	83
Toxaphene	Airplane	Cotton 8/	14
Methoxychlor	do.	Glass plates 9/	47
Methoxychlor	do.	Alfalfa	49
Methoxychlor	do.	Cotton	57
Organophosphate			
Parathion	Air blast	Citrus trees	22-35 10/
Parathion	do.	do.	28-39 10/
Parathion	Oscillating boom	do.	20-40 10/
Phenthoate	Oscillating boom and air blast	do.	14-26 10/

1/ Adapted from CRR 26, p. 597.

2/ Chromatography paper (46 x 57 cm) placed in top of cotton row, 50 cm above soil; 22% applied on soil.

3/ Chromatography paper (46 x 57 cm) placed in top of cotton row, 50 cm above soil; 35% applied on soil.

4/ Chromatography paper (46 x 57 cm) placed in top of cotton row, 50 cm above soil; 32% applied on soil.

5/ Cotton height, 50 cm; estimated 40% groundcover.

6/ Cotton height, 74 cm; 34% of applied on soil.

7/ Cotton height, 124 cm; 6% of applied on soil.

8/ Cotton height, 165 cm; 100% groundcover; none applied on soil.

9/ Glass plates installed in cotton and alfalfa.

10/ Values are the ranges of percent of applied pesticide found on ground beneath citrus trees. Unknown portion of remainder was intercepted by foliage.

Table D-11--Estimate of parameter values for commonly used pesticides

Common name	Trade name	Solubility in H_2O (ppm)	Foliage residue half-life (days)	k_s	k_d
Acephate	Orthene	650000.0	8.0	0.35	3.0
Alachlor	Lasso	242.0	3.0	0.0384	5.0
Atrazine	Atrazine	33.0	2.0	0.01	2.9
Bentazon	Basagran	500.0	2.0	0.069	1.0
Butylate	Sutan	45.0	1.0	0.033	1.3
Carbaryl	Sevin	40.0	7.0	0.0169	0.1
Carbofuran	Furadan	700.0	1.1	0.04	1.3
Chlorpyrifos	Lorsban	2.0	3.3	0.06	53.0
Cyanazine	Bladex	165.0	2.0	0.049	5.0
2,4-D (amine)	2,4-D (amine)	900.0	8.9	0.07	0.74
DEF	DEF	1.0	7.0	0.07	100.0
DiCamba	Banvel	4500.0	9.3	0.084	0.077
Dicrotophos	Bidrin	10000.0	20.0	0.1	0.2
Dinitro	Dinoseb	50.0	1/	0.03	4.9
EPN	EPN	0.5	5.0	0.14	200.0
Fenvalerate	Pydrin	0.02	42.0	0.01	740.0
Fluometuron	Cotoran	90.0	1/	0.06	2.0
Fonofos	Dyfonate	13.0	2.5	0.016	30.0
Glyphosate	Roundup	12000.0	2.5	0.023	5.0
Methyl parathion	Methyl parathion	60.0	3.0	0.14	10.0
Metolachlor	Dual	530.0	3.0	0.04	5.0
Metribuzen	Sencor	1220.0	2.0	0.029	0.2
MSMA	MSMA	570000.0	1/	0.07	4000.0
Paraquat	Paraquat	500000.0	3.0	0.007	100000.0
Permethrin	Pounce	0.5	35.0	0.015	1000.0
Phorate	Thimet	50.0	2.0	0.03	9.4
Profluralin	Tolban	0.1	1.0	0.005	22.4
Propachlor	Ramrod	580.0	3.0	0.058	5.0
Propazine	Milogard	8.5	2.0	0.008	2.1
Simazine	Princep	3.5	2.0	0.01	2.3
Sulprofos	Bolstar	45.0	0.5	0.05	5.5
Terbufos	Counter	15.0	2.5	0.139	30.0
Trifluralin	Treflan	1.0	20.0	0.01	19.2

1/ For CREAMS modeling purposes, preemergence herbicides and directed herbicidal sprays do not get on crop foliage, so a foliage residue half-life of 0.0 is assumed for these chemicals.